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Annual Report

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Nancy Leonard, Mike Banach, Greg Wilke, and Van Hare (PSMFC),
John Arterburn (Colville Tribes) and George Batten (ESA. for Colville Tribes),
Denise Kelsey, Tami Wilkerson, Sheryn Olson (CRITFC),
Evan Brown and Angie Schmidt (IDFG),
Dawn Anderson (MFWP),
Cedric Cooney, Jon Bowers, Jake Chambers, Nadine Craft, and Peter Robinson (ODFW),
Jen Bayer (PNAMP),
Todd Gilmore (USFWS) and
Brodie Cox (WDFW).

Pacific States Marine Fisheries Commission, Portland, OR 97202
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II. Executive Summary

StreamNet serves as a regional coordination body to support data management and facilitate cooperation across organizational boundaries. The Pacific States Marine Fisheries Commission (PSMFC) hosts the StreamNet project and its databases, which provide access to regional fish and fish-related 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 2022, which spans federal fiscal years 2021 and 2022. During calendar year 2022 StreamNet continued to implement the Coordinated Assessments Partnership (CAP) with the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) and engaged in collaborative efforts with all partners to advance the diversity and quality of shared data. Below is a brief highlight of these 2021 accomplishments:

- StreamNet continued to acquire fish data from our partners resulting in a total of 79,889 records submitted to the CAP Fish High Level Indicator (HLI) Coordinated Assessments Data Exchange (CAX) system, and a total of 18,164 records in the Fish Monitoring Data (trends system). Shoshone Bannock Tribes, the Nez Perce Tribe (NPT) and the Yakama Nation (YN) continued to engage and submit data, as feasible given they are not directly funded by BPA through the StreamNet project.
- Some specific accomplishments achieved by the individual StreamNet subcontracts related to development or improvement of their organizations' data storage systems include:
    - The Colville Tribes'.
    - Idaho Department of Fish and Game's.
    - Montana Fish Wildlife & Park's.
    - Oregon Department of Fish and Wildlife's.
    - Washington Department of Fish and Wildlife's.
- StreamNet continued to improve its online queries to better support data consumer needs, such as working on a prototype for a new query to properly display age-data related to the Fish Monitoring Data. Working with the Fish Monitoring Work Group (FMWG) task teams, StreamNet developed a prototype to display available HLI population estimates for Columbia Basin Partnership Task Force (MAFAC), and compiled information on status of data availability for salmon and steelhead populations without HLI estimates to display on the CAP Fish HLI queries, both of which are being further refined per recommendations from StreamNet committees' members. PSMFC GIS center staff and StreamNet IDFG data steward continued to co-lead a FMWG task team to define a consistent approach for developing and naming fish management unit polygons to display data for non-anadromous salmon and steelhead species. StreamNet provided additional, non-BPA, funding to contribute to advancing tribal data management and sharing capacity to Shoshone Bannock Tribes.
- PNAMP and StreamNet co-organized a symposium during the 2022 American Fisheries Society annual meeting in Spokane Washington, titled *Bringing it all Together: Data Integration for Fisheries Research and Management Success* that had several speakers from within the basin as well as from outside the U.S.A. The symposium consisted of 16 oral presentations followed by a panel discussion. We also held in November 2022 the Emerging Technology Information Session (ETIS) that had more than 100 in-person and virtual attendees and included 44 presentations by presenters from the Pacific Northwest region as well as from Canada, Belgium, and Taiwan.

Recommendations to the Executive Committee:

- Support **expanding data flow for resident and anadromous fish** (hatchery and natural-origin) from agency/tribal data systems to StreamNet data systems that contribute to informing the NPCC 2020 Addendum (goals, objectives and indicators for natural-origin and hatchery fish); and BPA and U.S. Fish and Wildlife Service (USFWS) information needs.

- Support **implementation of the Five-Year Plan for the Coordinated Assessments Partnership** by strongly encouraging BPA, NPCC, and USFWS to build on StreamNet/CAP standardized data sharing successes for improving access to fish and related habitat data.
- Encourage NPCC, in addition to BPA, to officially recognize PSMFC StreamNet GIS and the StreamNet database systems (Fish HLI and Fish Monitoring Data) as the **system of record for the Columbia River Basin Fish and Wildlife Program**.
- Assist in **securing funding** to support StreamNet and CAP task maintenance, data quality, automation of the entire data flow process including calculations, and new tasks to better support the reporting needs of BPA, NOAA, NPCC and USFWS.
- Confirm with StreamNet partners the status of new tasks, to ensure these are **completed before deciding to add on new tasks**. Work with the StreamNet technical committees to ensure that tasks are being completed.
- Support **participation by all data providers and regional data consumers** in StreamNet and CAP committees and teams, including engagement in PNAMP Fish Monitoring Work Group (FMWG) and related teams that advance StreamNet and CAP tasks.
- Support implementation of the CAP Fish HLIs **StreamNet Quality Assurance Quality Control Plan.**
- Facilitate access to, and advance **metadata documentation** within agencies' and tribes' data systems, especially for data of regional importance. Explore options to more efficiently connect metadata residing in other systems with data managed by StreamNet.
- Provide **timely updates for the data categories that are to be submitted as spatial data** (file geodatabase feature classes, and thus, continue to support the collection, update and exchange of foundational datasets by contributing agencies and tribes.
- Adequately **support state and tribal data management personnel** and participation in StreamNet processes.
- Explore opportunities and assess processes to **connect regional data and information systems**
- Strengthen **engagement and coordination among data stewards** (e.g., database administrators, programmers, GIS experts) by committing to regular StreamNet and CAP Technical Team meetings

Lessons Learned:

- Ensuring **efficient data flow** requires ongoing maintenance and updates, including adopting advances in data management and reporting technology (open source and proprietary programs and tools) to improve efficiencies across the entire data life cycle. Several of the data providers are adopting a more automated data flow from field data collection to StreamNet's data systems, which would be beneficial for all data providers to pursue.
- Communicating the **quality of submitted data** provides data consumers with confidence in their use of these data.
- Improving **access of data** maintained by StreamNet to audiences with different technical knowledge will increase the value and use of these data by the public and for informing decisions.
- Leveraging **special work groups** and FMWG task teams with the required expertise (e.g., data stewards, biologist) to inform addition of data categories is efficient and effective, including coordinating with PNAMP staff for meeting facilitation expertise.
- Proper **documentation** for data integrity is critical to ensure that these valuable data, funded by the public and ratepayers, remain accessible to inform critical uncertainties and decisions into the future.
- **Succession planning and recruitment** of new partners and members that require documenting and publicly communicating information about StreamNet Program and its processes. Succession planning also requires partner agencies and tribes to document new and existing processes used in data management to ensure smooth staff transition.

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 (CRB or basin) and the Pacific Northwest as a whole. Specifically, for the StreamNet Program, 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 data. This work improves data discovery, increases efficiency of data access, and facilitates data reuse – ultimately, adding value to data collection efforts.

A. Project Background

StreamNet is a collaborative data sharing project that works with the federal, state and tribal agencies, and other partners such as PNAMP 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), Columbia Habitat Monitoring Program (CHaMP), and US Congress funded Hatchery Reform Group and Hatchery Scientific Reform Group (HSRG) reports and data sets. Data submitted to StreamNet are region-wide in coverage, with recent years being more focused on Columbia Basin data in response to regional needs, which overlaps with the Pacific Northwest region-wide coverage through the CAP. The geographic extent of StreamNet reflects the 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, to properly address regional reporting and decision-making processes. 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 overlaps 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 primarily 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 and tribe collecting the data.

Figure 1: StreamNet focuses its data sharing efforts on data within the Columbia River basin. However, data from all Pacific States are exchanged 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. 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). The NED had previously integrated data from the Hydro Assessment Study (HAS), specifically data from the Northwest Hydropower Database and Analysis System (NWHS) and Pacific Northwest Rivers Study (PNWRS). Over time the original StreamNet project evolved to adopt technology that facilitated data sharing and to respond to information needs from regional decision-making efforts (Figure 2).

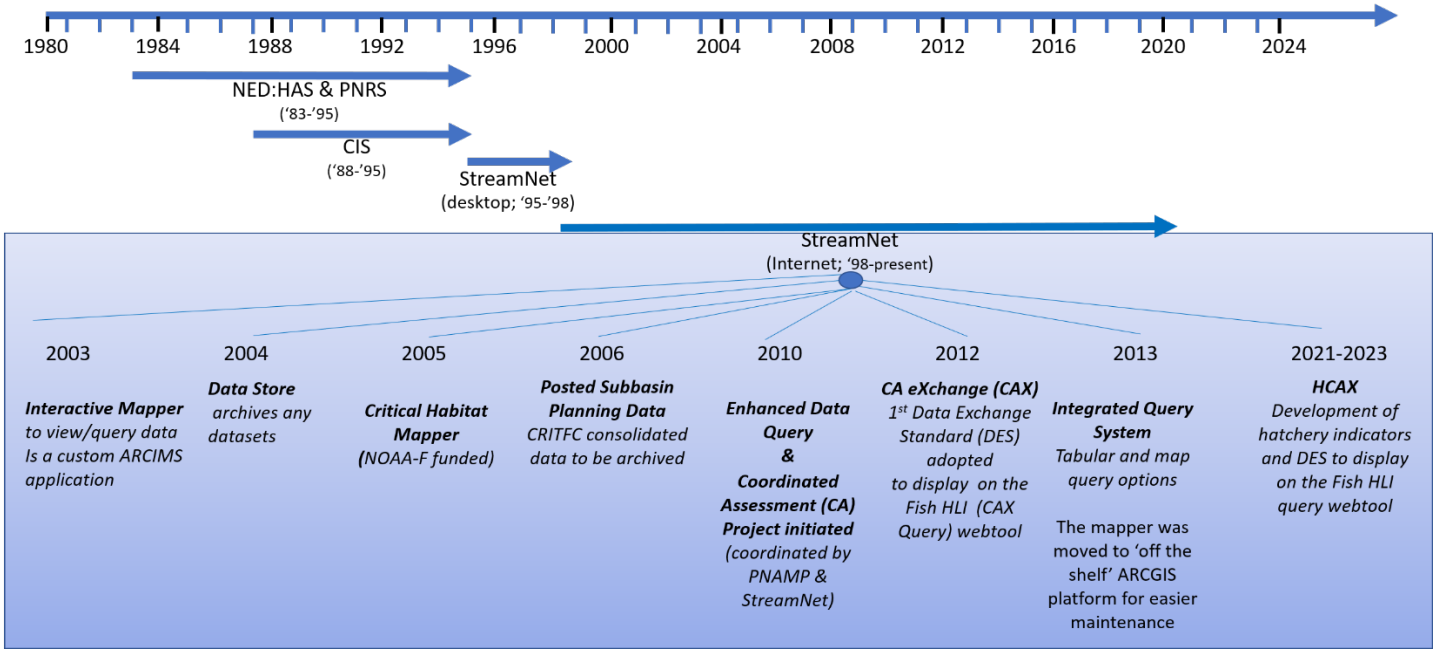


Figure 2: Timeline showing the merging of CIS and NED in 1995 to form the StreamNet project and its subsequent evolution to the current day StreamNet data sharing project.

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 2012 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 (Figure 3),
- 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 (co-led by Pacific Northwest Aquatic Partnership (PNAMP) and StreamNet),
- Continued to evolve towards a more accessible platform for various users and optimize webservices to facilitate coordinated data-sharing and data depiction, including updating its main website and developing an 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 Federal Columbia River Power System (FCRPS) Biological Opinion (BiOp) reports for priority populations.

The most recent NPCC recommendation, the August 2019 programmatic and project recommendations[iii], continues to support the StreamNet project. Specifically, the NPCC recommended that StreamNet continue its effort to expand its steering committee membership to agencies managing fish data and that StreamNet initiate work on other priority NPCC program indicators including hatchery indicators. To this end StreamNet continues to seek opportunities for expanding the Coordinated Assessments Partnership (CAP or Partnership) High Level Indicators (HLIs) to other categories and fish species. This intent has also resulted in a stronger relationship between StreamNet and the Pacific Northwest Aquatic Monitoring Partnership, by leveraging the existing PNAMP FMWG to serve as the forum to bring together biologists, data stewards, and other interested parties to refine existing StreamNet and CAP tools and to inform new data categories to be exchanged. StreamNet's prioritization of work continues to be informed by the Five-Year Work Plan for the Coordinated Assessments Partnership.

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. StreamNet committees' members currently include the four states, Colville Tribes, CRITFC and CBF&W Library. StreamNet teams include representatives from additional data providers, such as the Nez Perce Tribe and Yakama Nation Fisheries.

B. Coordinated Assessments Partnership

The Partnership 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 US Fish and Wildlife Service) of the CRB for fish-related data. The CAP 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 Partnership 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 Coordinated Assessments Data Exchange, called CAX, was partially funded by a 2015 EPA Exchange Network grant (Salmon Coordinated Assessments Data Exchange project #83546401, closed). Close contact with High level indicators (HLIs) users (BPA, NPCC, NOAA, others) and with regional fish and wildlife managers is maintained and is crucial to the success of the project.

The partnership is focused on sharing standardized regional HLIs for the health of fish populations. CAP 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 CAP to be a collaborative, consensus-based effort. Parties involved in the CAP remain flexible so that participants with the required expertise (e.g., resident fish managers, habitat managers, etc.) will be recruited as needed, as CAP moves to additional indicators. Since 2010, the agencies and tribes within the CRB participating in the CAP have successfully developed the CAX. The CAP Fish HLIs query has effectively communicated and made accessible natural-origin salmon and steelhead population HLIs to decision-makers and other interested parties. The CAP Fish HLIs query 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 B for crosswalk between NPCC populations and CAP Fish HLIs populations). Funding has been the limiting factor for expanding the CAP Fish HLIs query beyond natural origin salmon and steelhead HLIs, and only recently has work begun to expand to hatchery origin fish HLIs.

The second five-year plan for the CAP (CAP plan) 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; a revised version was adopted November 2022 by the StreamNet Executive Committee. The CAP Plan guides the implementation of work by prioritizing data for contribution from partners. The primary data types contained in and disseminated through the CAP relate to the Viable Salmon Population (VSP) parameters, population scale estimates of natural spawner abundance, smolt to adult ratio, adult recruits per spawner (spawner to spawner ratio), smolt outmigrants, and presmolt abundance. In addition to high level indicator data, Fish Monitoring Data (e.g., trends data sets) are also curated by StreamNet, including spawner counts, juvenile counts, redd counts, and dam and weir counts. Beginning in 2023, HLIs and metrics related to hatchery-origin fish will be exchanged through the Hatchery Coordinated Assessments Exchange (HCAX) as agreed through a collaborative process that identify the indicators and metrics supporting regional needs. The CAP Plan also indicates other fish species, e.g., sturgeon, and category of data, e.g., hatchery indicators, genetic data, as priorities, and these will be explored as additional funding and resources become available. Implementation of the plan will require resources from a diversity of sources to provide access to the data approved by the Executive Committee. For instance, the CAP members secured a USEPA Exchange Network grant in 2015 that was focused on sharing natural origin salmon and steelhead HLIs, and in 2020 the CAP Core Team was awarded an EPA Exchange Network Grant that is funding the development of a data exchange standard and pilot flow of hatchery fish HLI during 2021-2023.

C. Policy Guidance

The StreamNet project is implemented following the guidance provided in the 2021-2026 StreamNet Vision and Strategic Plan [v] (adopted September 2, 2020) and through the collaboratively developed CAP Plan, which are adopted by the StreamNet Executive Committee. The CAP Plan is updated annually, while considering a 5-year implementation period. The direction provided by the CAP Plan considers guidance from NPCC Program and Project Recommendations, which in turn 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 CAP Plan and the 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:

- Manage data in a manner that is searchable and usable by interested parties.
- Properly document metadata associated with data and ensure these are 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.
- Produce derived estimates and indicators (e.g., population estimates) from preliminary data collection (e.g., redd counts) and make publicly accessible along with supporting data.
- Work 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.
- Facilitate collaboration among agencies, tribes, and tribal consortia, 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 needs to be addressed first, based on the Program's guidance.
- Refine 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 Data Accessibility

BPA's Environment & Fish and Wildlife Division staff interact on a regular basis with StreamNet staff to communicate their data needs. The data priorities have expanded since the more restrictive 2016 Tier 1 and Tier 2 priority populations that were associated with data needs for the previous FCRPS BiOp. During 2022, BPA staff indicated interest in collaboratively working through the FMWG and its task teams to expand accessibility of standardized data that could be exchanged with StreamNet or other regional systems, as well as interest in collaboratively developing a standardized approach to inform how StreamNet would display fish management units for non-ESA species. During 2022, BPA also indicated interest in assessing how StreamNet could use ESRI dashboard to display multiple data sources related to a specific topic to facilitate BPA Contracting Officer Representatives tasks. Interest in further relying on StreamNet and its support by the PSFMC GIS center to serve as the system of record for fish and facilities GIS layers was communicated by BPA signaling that it was interested in having CBFish.org display GIS layers maintained by PSMFC GIS Center as part of the StreamNet project.

3. High Level Indicators and Metrics Categories

The high level indicators (HLIs) and metrics, which have guided the work of the CAP 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 FCRPS BiOp[vi] and related documents. With the adoption of the 2020 Northwest Power and Conservation Council Columbia River Basin Fish and Wildlife Program, the StreamNet Executive Committee approved StreamNet to work collaboratively with others, leveraging the PNAMP FMWG, to develop recommendations for Executive Committee's review that would better address the NPCC strategic performance indicators. The Hatchery Coordinated Assessments Exchange (HCAX) process initiated in 2021 resulted in the development of a controlled vocabulary informed by hatchery biologists, hatchery data stewards, and regional hatchery data consumers that is informing the prioritization of hatchery fish indicators and metrics for the pilot data exchange in 2023. These HLIs, as well as others identified in the 2022 revised CAP Plan, continue to be a priority.

4. Fish Monitoring Data (Trends) Data Set Priorities

The 2014 NPCC Fish and Wildlife Program[vii] provides guidance on the information needed to track the status of the CRB's fish and wildlife resources (Part Two, section V), report on the Program's approved high-level indicators (see 2014 Program, Appendix D), and assess progress towards Program goals, objectives and indicators (see 2014 Program Appendix C and its draft 2020 Addendum Part 1A). During 2018, the Executive Committee directed the StreamNet project to resume updating selected, traditional data sets, such as long-term sets that support CAP indicators and those that are used to maintain the NPCC program reporting needs. This continues to be a priority for StreamNet as available resources allow. The 2020 addendum to the Northwest Power and Conservation Council Columbia River Basin Fish and Wildlife Program identified a set of Strategy Performance Indicators. NPCC staff lead a regional process that refined the Strategy Performance Indicators and supporting data. This process is clarifying data needs for the NPCC Program Tracker and will serve to specifically identify the fish species and data categories priorities.

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, CAP and other PSMFC programs. It enables discovery and display of the CAP Fish HLIs at the population scale and drives the web-based mapping components of the CAP Fish HLI map-based query system and the maps embedded within the Fish Monitoring Data query system that depict the time series data sampling location. StreamNet's core GIS data layers are recognized as BPA's system of record for mapping fish facilities (e.g., hatchery, weirs), fish distribution within the basin, trends features, and non-TRT populations. 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. As BPA and NPCC continue to clarify what GIS layers PSMFC can provide to better support their reporting tools, such as

NPCC's Program Tracker, BPA PISCES (CBFish.org), and PNAMP's MonitoringResources.org, additional GIS layers are being developed by the GIS Center, such as focal species probably range maps that are informed by the work reviewed through a FMWG task team.

D. Budget Considerations

Calendar year 2022 spans two fiscal years (FY), FY22 from January to September 2022 and FY23 from October to December 2022. For FY22and FY23, BPA adjusted the StreamNet baseline budget from $2 million annually to $2,069,137 annually. The $69,137 is allocated to the PSMFC StreamNet portion of the budget that was reduced by $145,483 to address BPA's 2018/2019 financial crisis. The overall StreamNet budget remains smaller than the FY2017 amount ($2,145,483 annually) recommended by the NPCC in their 2019 project recommendation[viii] (Figure 4). This permanent increase to the StreamNet budget in FY22 services supports the PSMFC GIS Center lab, PSMFC StreamNet staff, and contributed to funding a technical subcontract. However, this increase is not sufficient to fill the position that was lost from PSMFC StreamNet following the 2018/2019 reduction. To further address this gap, the StreamNet Program Manager, in FY22 took on additional data management programs at PSMFC, specifically RMPC/RMIS and FINS. Funds were also reallocated to advance additional tasks, including those requested by BPA, by supporting a few months' time of another PSMFC employee and to increase funding to the technical support subcontract. The partner agencies did not receive an increase during CY2022 (FY22 and FY23) with the exception of ODFW which shifted funds from other BPA projects in its BPA project portfolio to its StreamNet subcontract.

To alleviate the financial constraints experienced by StreamNet partners, PSMFC StreamNet staff are continuously seeking alternative funding sources to maintain and address new tasks to support priorities. During calendar year 2022, PSMFC StreamNet secured Interjurisdictional Fisheries Act (IJFA) funding to address the ongoing budget shortfall needed to cover StreamNet PSMFC staff, to further advance StreamNet by supporting tribal data management and exchange capacity (Shoshone Bannock Tribes), USGS-PNAMP staff time to assist with CAP related tasks, and subcontracting for additional technical support. This added funding directed at specific StreamNet tasks complement the limited PSMFC StreamNet FTE and assist in making progress on several BPA priority tasks during CY2022 and 2023 (FY22 and FY23).

Similarly, the CAP Core Team seeks funding from alternative sources as feasible. For instance, in 2015 the CAP 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 CAP Core Team and StreamNet Steering Committee also submitted a proposal to advance hatchery indicators in 2020. This proposal was selected for funding by EPA and the Hatchery Coordinated Assessments Data Exchange (HCAX) work was initiated late in 2020 and will continue to late 2023. This proposal was by Washington State Recreation and Conservation Office / Governor's Salmon Recovery Office with WDFW, The Colville Tribes, PNAMP and StreamNet as sub-awardees, and with Idaho Department of Fish and Game (IDFG) and Oregon Department of Fish and Wildlife (ODFW) being funded through subcontracts from this funding. StreamNet partners also seek and secure additional funding which complement and contribute to advancing StreamNet and CAP tasks, such as the individual EPA Exchange Grants secured by CRITFC in 2016, and those secured by WDFW and YN.

The overall StreamNet budget constrains the ability of PSMFC staff and partners to address the information and tasks requested by BPA in the time frame desired. The lack of cost-of-living increases in the BPA budget compounds this constraint over time as shown in Figure 4, which shows the decrease in the budget's nominal and real value since 2004. As rates and fees increase over time, PSMFC StreamNet and partners struggle to maintain and recruit staff with required expertise. Furthermore, the ability for PSMFC StreamNet to support short-term data management needs of Tribes not funded through the StreamNet Program will be further reduced. The absence of additional funds provided by BPA to PSMFC StreamNet to annually fund Tribes with data that are relevant to BPA and appropriate for StreamNet data systems weakens the reliability of data flow from these providers.

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). The Colville Tribes joined in CY2013 (FY2014) 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 (CRITFC) and its member tribes, Columbia Basin Fish & Wildlife Library (CBF&W Library or Library), and Pacific Northwest Aquatic Monitoring Partnership (PNAMP). During CY2020, Yakama Nation (YN) and CRITFC completed their subcontracted tasks for improving data management and sharing capacity, and the Shoshone Bannock Tribes subcontract was extended in CY21 and increased to further assist them with data sharing that informs the CAX database. Up until 2017, the USFWS was funded through StreamNet, but no longer receives StreamNet funding. In calendar year 2018 BPA and the USFWS reached agreement on funding these activities through a direct contract focused on integrating USFWS hatchery databases.

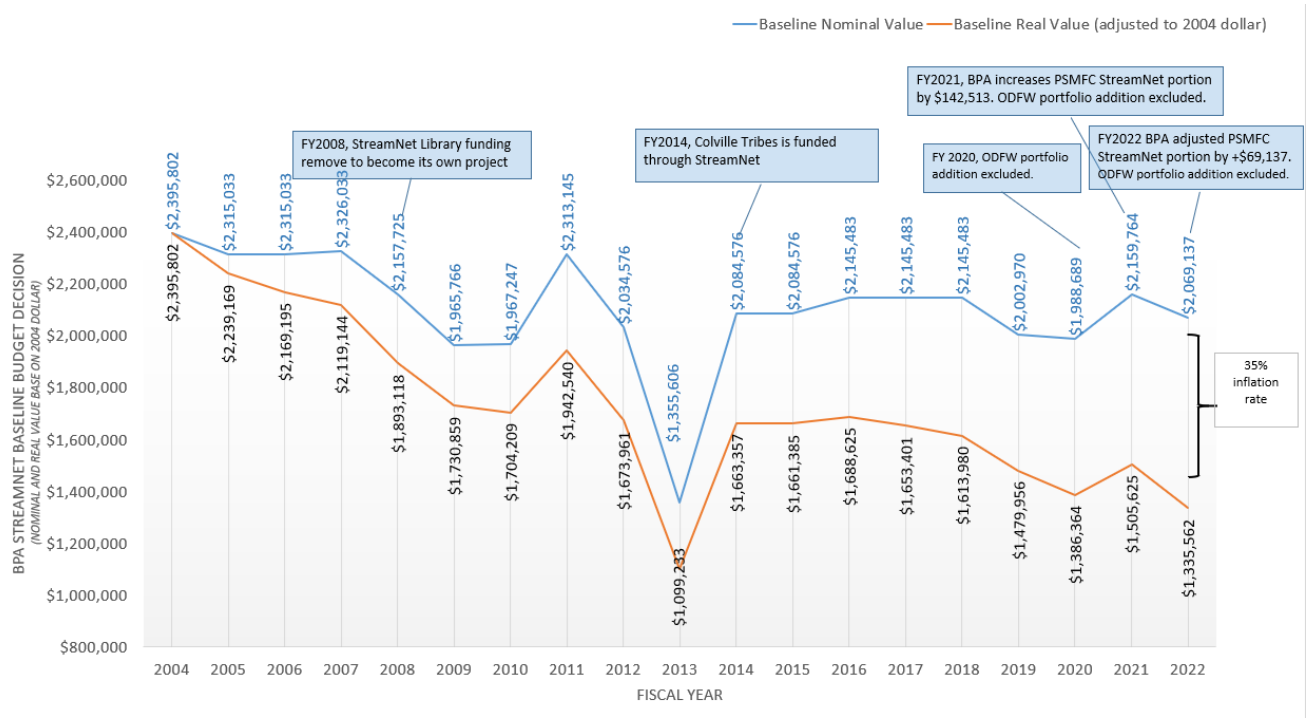


Figure 4: BPA annual budget decision for the StreamNet project between FY2004 and FY2022. In 2008 the Library was split from the StreamNet project and assigned its own project number and budget (BPA project # 2008-505-00). The sharp decrease in FY2013 arose from the percent cut made by BPA across all projects to address a BPA financial crisis. The cut in FY2013 resulted in substantial PSMFC staff time being reallocated to other PSMFC projects until the budget was readjusted to a higher amount in FY2014. Additionally, the FY2013 cut resulted in all PSMFC GIS support no longer being funded through the StreamNet budget from FY2013 to FY2020. 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. In FY2021 BPA reinstated the StreamNet baseline for one-year (excluding ODFW portfolio funds) budget to $2,145,483, the value recommended by the NPCC in 2019. The FY 2022 BPA budget for StreamNet was adjusted to $2,069,137 (excluding ODFW portfolio additions). *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.in2013dollars.com/us/inflation/

IV. Approach and Methodology

StreamNet[ix] supports a regional approach to data management, coordination, and standardization by increasing partner capacity and improving access to fish data (Figure 5). The majority of fish-related data originate with the region's state, tribal and federal fisheries agency's 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 time-series data and high-level indicators to its regional databases at PSMFC by supporting technical staff inside these agencies to help increase the capacity of partners with managing, standardizing, and providing related GIS layers. PSMFC and StreamNet funded agency employees and subcontractors locate data, standardize data reporting through the cooperative development of data exchange standards, complete Quality Assurance/Quality Control (QA/QC), and assure the flow of data from state, tribal, or agency repositories to StreamNet. StreamNet supports individual agencies and tribes to work collaboratively in the exchange of data contributing to regional decision making.

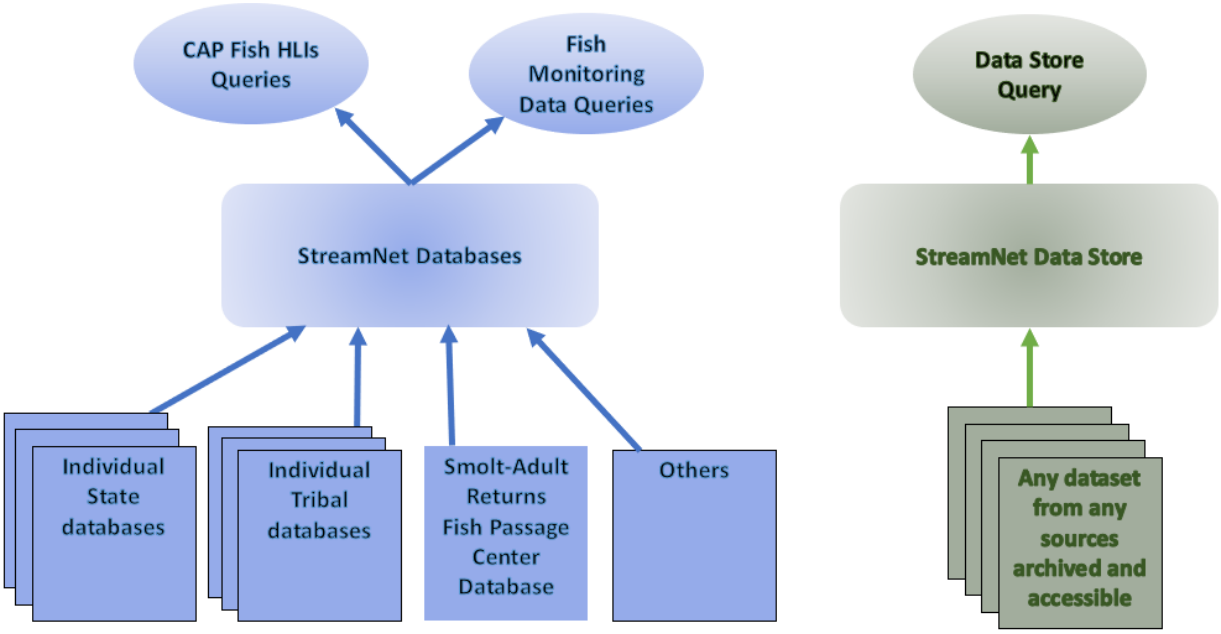


Figure 5: Flow of data from StreamNet members' agency/tribal databases, sub-regional databases, and other sources, to the StreamNet and StreamNet online data access queries.

A. Standing Committees for StreamNet and Coordinated Assessments Partnership

Work Elements:	189: Coordination and Outreach

There are several committees and teams that contribute to the implementation of StreamNet tasks, including an Executive Committee, a Steering Committee, and supporting workgroup and teams (Figure 6). The Coordinated Assessments Partnership (CAP) 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.

The CAP and StreamNet are both discussed and considered by the StreamNet Executive Committee when developing the StreamNet annual work plan and the Five-Year Plan for Coordinated Assessments to inform data priorities.

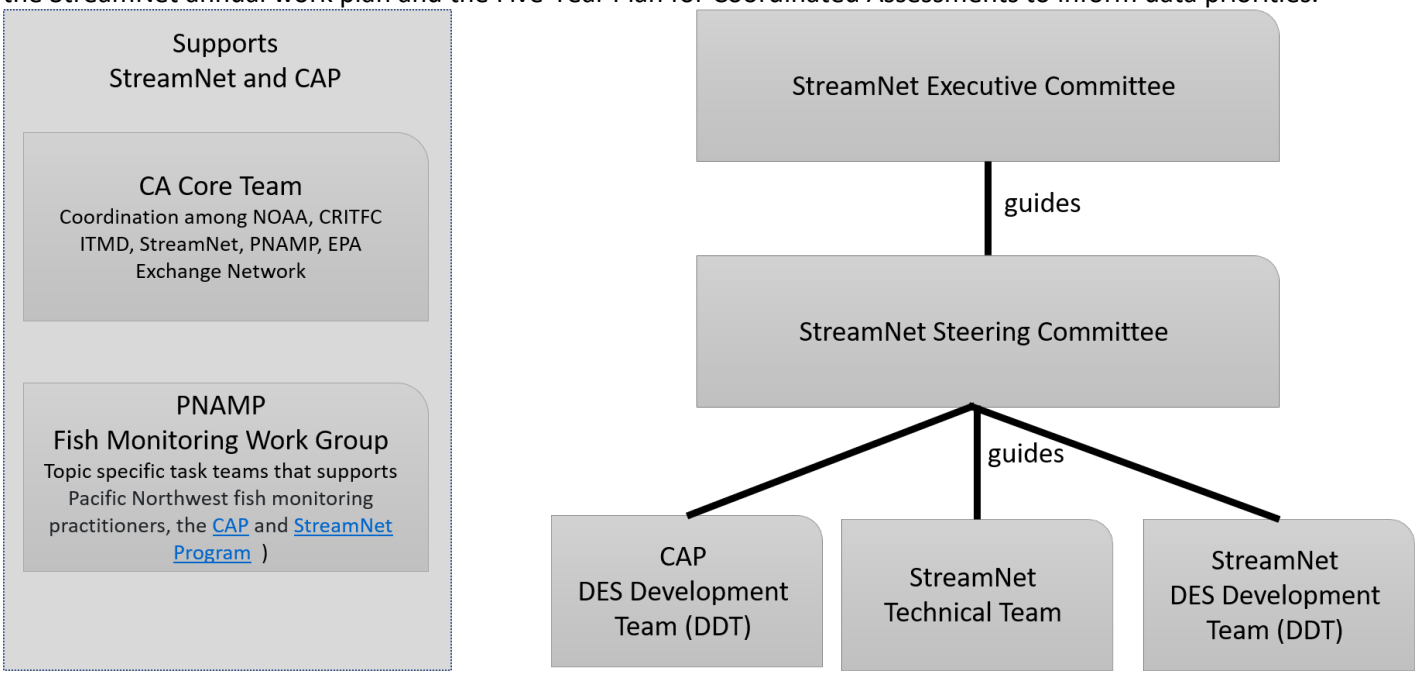


Figure 6: Relationship among the StreamNet organized committees and teams, the CA Core Team, and the PNAMP Fish Monitoring Work Group that all contribute to StreamNet and CAP related work.

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, more details on the StreamNet Executive Committee webpage). 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 Partnership. This guidance includes review of the high-level goals and products of the Coordinated Assessments Partnership, CAP Fish HLI query (CAX data system), Fish Monitoring Data (trends) data system and its queries, and making decisions on priority species, populations, indicators, on a long-term and an annual basis. The Executive Committee reviews and annually approves the Five-Year Plan for the CAP to ensure that the regional data priorities are being addressed with the data exchanged with StreamNet.

Table 1: Calendar Year 2022 members of the StreamNet Executive Committee

Current Members	**Affiliation**
Barry Thom (Chair, represented by Nancy Leonard) and Stan Allen (Randy Fisher retired March 2022)	PSMFC
Sheryn Olson and Doug Hatch	CRITFC
Patty O'Toole	NPCC
Jody Lando and Rodrigo George	BPA
Greg Sieglitz	NOAA-Fisheries
Tom Stahl and Art Martin	ODFW
Dan Rawding	WDFW
John Cassinelli	IDFG
David Schmetterling	MFWP
John Arterburn	Colville Tribes
John Netto	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 Fish Monitoring Data (trends) and CAP Fish HLI. This committee includes active participation by StreamNet and non-StreamNet members at the data manager level (Table 2, more details on the StreamNet Steering Committee webpage). This includes NOAA, BPA, NPCC, state agencies, and some tribal representatives. The committee is made up of technical project leaders from StreamNet partner agencies and other related organizations involved in managing fisheries data and metadata, with a focus on the Columbia Basin. The chair is the PSMFC StreamNet Program Manager.

Table 2: Calendar Year 2022 members of the StreamNet Steering Committee

Current Members	Affiliation
Nancy Leonard (Chair)	PSMFC
Sheryn Olson	CRITFC
Tami Wilkerson	CBF&W Library
Kris Holmes	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
Todd Gilmore	USFWS
Jen Bayer	USGS-PNAMP

3. StreamNet Technical Team

The Technical Committee is composed primarily of PSMFC and state and tribal agency staff from StreamNet partners that implement data management actions (Table 3; more details on the StreamNet Technical Team webpage). The committee is chaired by PSMFC StreamNet staff, with the staff assigned dependent on the team's current task. The team designs and implements the technical details necessary to share data from partner data systems to the StreamNet database and on to end users. The team provides a forum to discuss data, programming, GIS topics, and common issues among organizations contributing data to the StreamNet data system, focusing on geographic referencing, Fish Monitoring Data (trends), CAP Fish HLIs, fish distribution data, other data types, and metadata submissions to the StreamNet data system.

Table 3: Calendar Year 2022 members of the StreamNet Technical Team

Current Members	Affiliation
Greg Wilke (co-chair) and Mike Banach (co-chair)	PSMFC-StreamNet
Van Hare	PSMFC-GIS Center
Denise Kelsey, Tami Wilkerson	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	MFWP
Todd Gilmore and David Hines	USFWS
John Arterburn, George Batten (Environmental Science Associates consultant)	Colville Tribes
Michelle Steg-Geltner	Yakama Nation

Currently there are no StreamNet Technical Team members identified for CTUIR, CTWSRO, NPT and SBT.

4. StreamNet Data Exchange Standard Development Team (SN DDT)

The StreamNet DES Development Team (SN DDT) meets as necessary to maintain data-sharing rules for Fish Monitoring Data and documents the rules in the StreamNet Data Exchange Standard (DES). A DES is a set of formal rules for the meaning and structure of shared data. The SN DDT collaborates with the StreamNet Executive Committee (SN ExCom) and StreamNet Technical Team (SN TT) to determine how these data should be presented and made available via online query systems. The SN DDT consists of biologists, data management, and IT technical staff from the federal, tribal, state, and regional organizations submitting and consuming data (Table 4, see SN DDT webpage for details). Most member organizations have more than one individual participating on the SN DDT who contribute to discussions, product development, and decisions. The SN DDT is organized and facilitated by Pacific States Marine Fisheries Commission (PSMFC) StreamNet staff, with the PSMFC StreamNet Regional Fishery Biologist / Database Administrator serving as chair.

Table 4: Calendar Year 2022 members of the SN DDT

Current Members	**Affiliation**
Greg Wilke and Mike Banach (Chair)	PSMFC-StreamNet
Van Hare	PSMFC-GIS Center
Denise Kelsey, Tami Wilkerson	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	MFWP
Todd Gilmore and David Hines	USFWS
John Arterburn, George Batten (Environmental Science Associates consultant)	Colville Tribes
Michelle Steg-Geltner	Yakama Nation

Currently there are no StreamNet Technical Team members identified for CTUIR, CTWSRO, NPT and SBT.

5. Coordinated Assessments Partnership Data Exchange Standard Development Team (CAP DDT)

The CAP 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. Team membership is fluid and depends on the species/indicators/geography of the data (Table 5, see the CAP DDT webpage for details). The chair of the DDT is the PSMFC StreamNet biologist.

Table 5: Calendar Year 2022 members of the CAP DDT

Current Members	Affiliation
Mike Banach (Chair) and Nancy Leonard	PSMFC
Denise Kelsey	CRITFC
Russell Scranton and Matthew Schwartz	BPA
Mari Williams and Monica Diaz	PSMFC / supporting NOAA-Fisheries data needs
Jake Chambers, Nadine Craft, Kasey Bliesner, and Cedric Cooney	ODFW
Brodie Cox, Greg Lippert, Dan Rawding, and Michelle Groesbeck	WDFW
John Powell, Evan Brown, and Rebecca Waskovich	IDFG
George Batten (ESA consultant for the Colville Tribes)	Colville Tribes
Jay Hesse and Ryan Kinzer	Nez Perce Tribe
Michelle Steg-Geltner	Yakama Nation
Jen Bayer	PNAMP

In 2022, during the development of a pilot data exchange standard for the Hatchery Coordinated Assessments Data Exchange (HCAX), a slightly different group of experts than the official CAP DDT members listed above participated in the HCAX Data Core Team that developed the HCAX DES. Led by the CAP DDT chair, the individuals and entities who contributed to the development of the draft HCAX DES and the data type section they focused on are listed below:

HCAX Data Core Team Member	DES Data Type Section
MFWP – Ace Riverman	Program information
NPT – Clark Watry	Program information
CRITFC – Denise Kelsey	Program information
Colville Tribes – George Batten	Adult information
ODFW – Jake Chambers	Adult information
MFWP – Ace Riverman	Juvenile releases
WDFW – Brodie Cox	Juvenile releases
USFW – Todd Gilmore	Juvenile releases
WDFW – Danny Warren	SAR
IDFG – John Powell	SAR
PSMFC – Mike Banach	SAR

6. Coordinated Assessments Partnership (CAP) Core Team

The CAP Core Team meets regularly to coordinate amongst several BPA-funded projects. The Core Team is made up of representatives from BPA, NOAA, PNAMP, StreamNet, a StreamNet partner agency/ EPA Exchange Network representative, and the CRITFC Inter-Tribal Monitoring Data project representative. The CAP Team (Table 6) are important leaders in ensuring that CAP produces results by facilitating discussion amongst projects, directing requests for work to the appropriate CAP level (as needed), and generally maintaining forward momentum. The team also manages and implements periodic CAP Workshops.

Table 6: Calendar Year 2022 members of the CAP Core Team

Current Members	Affiliation
Nancy Leonard	PSMFC
Denise Kelsey, Sheryn Olson	CRITFC
Russell Scranton and Matt Schwartz	BPA
Mari Williams	NOAA-Fisheries
Brodie Cox	StreamNet partner representative (WDFW)
Jen Bayer	PNAMP
Sheryn Olson, CRITFC ITMD lead	StreamNet Tribal Outreach
John Arterburn *(added in 2020 for HCAX coordination)*	Colville Tribes
Keith Dublanica *(added in 2020 for HCAX coordination)*	WA GSRO

B. StreamNet Data Specialists within Agencies

Work Elements:
159: DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX)
159: Transfer of data to secure and accessible repositories
159: CAP Fish HLI (CAX) – DES, API, Database
159: Fish Monitoring Data (Trends) – DES, API, Database
160: StreamNet maintaining and enhancing data management
160: Implement and participate in processes described in the StreamNet QA/QC
189: Supporting Data Requests

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 and metadata, convert these to the DES adopted by StreamNet, perform Quality Assurance/Quality Control (QA/QC, see StreamNet Quality Assurance and Quality Control Plan version February 7, 2022), provide related GIS information, 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 downloading in standardized format through the project website, www.streamnet.org. Data submitted by data stewards may also include data from other agencies and tribes, because state agencies often collect data from partners to summarize Fish Monitoring Data (FMD) (trends) and calculate metrics or indicators that are reported on CAP Fish HLIs queries.

C. Data Store - Archiving Data Sets and Information

Work Elements: 159: Transfer of data to secure and accessible repositories
161: Improving data sharing with and access from StreamNet Data Systems

StreamNet staff continues to maintain public access to structured information for the NPCC FW Program including the CHaMP, Data Store, HEP, the HSRG, Protected Areas and Subbasin Plans. 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.

CHaMP –StreamNet maintains, as requested by BPA, access to archived information from the Columbia Habitat Monitoring Program (CHaMP) including documents, photos, and data sets. StreamNet added a CHaMP page[x] to its website for this purpose and included a CHaMP Data File Explorer to facilitate searching the files sent to StreamNet. CHaMP was funded as a pilot project by BPA between 2011 and 2017 to assess if it could help address the requirements of the 2008 Federal Columbia River Power Supply (FCRPS, now CRS) BiOp and RPA 56.3. In 2018, the CHaMP project was phased out following an NPCC recommendation. The extensive volume of documents and datasets from Environmental Services Associates' (ESA, formally Sitka Technology Group) champmonitoring.org website are being archived as these are received from ESA on the StreamNet's CHaMP website.

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 that 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 who 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.

HEP – StreamNet also maintains the NPCC's Columbia River Basin Fish and Wildlife Program's (Program) Wildlife Habitat Evaluation Procedures (HEP) documents and data[xiii]. 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's progress in BPA's mitigation for lost 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 lost habitat and these are tracked by the NPCC.

HSRG – StreamNet staff have begun integrating the content of the Hatchery Reform Project website[xiv] to ensure that its content, including the Hatchery Scientific Reform Group's (HSRG) documents remain accessible to the public through the refreshed StreamNet website that was released during 2021. The NPCC FW Program policy guidance for its *Fish Propagation including hatchery programs*[xv] 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[xvi] is needed to inform implementation of this policy guidance.

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[xvii]. 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.

Subbasin Plans – StreamNet maintains documents and data sets[xviii] 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 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 Ecosystem Diagnosis and Treatment (EDT) and Qualitative Habitat Assessment (QHA) modeling information used in subbasin planning, as well as GIS layers that define the EDT/QHA reach codes.

D. Fish Monitoring Data (trends)

Work Elements:	159: DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX) 159: Fish Monitoring Data (Trends) – DES, API, Database 160: StreamNet maintaining and enhancing data management 161: Improving data sharing with and access from StreamNet Data Systems

StreamNet Fish Monitoring Data (trends) query system[xix] provides access to all data sets submitted to the StreamNet database (excluding content from the Data Store). These data are also georeferenced. The StreamNet Fish Monitoring Data query was refreshed in CY2020 to better integrate with the StreamNet website and supports a simpler filter-based query in a tabular format. During CY2021 a visual map depicting the location of the data set was added by connecting to the PSFMC StreamNet mapper, and work was initiated to improve access to the age data time series. This tabular query allows the user to filter data in different ways to suit their needs and download the resulting data or share a URL to the filtered content. The content of StreamNet's Fish Monitoring Data query system includes fish abundance estimates and indexes of redd and spawner counts at the local scales for native and non-native species, many of which are focal species for the 2014 FW Program, as well as information on hatchery returns, and harvest. Data sets relating to monitoring activities such as redd counts and dam counts are generally updated annually.

Content is updated annually, or less frequently as needed, for data types included in the StreamNet Data Exchange Standard (DES) for Fish Monitoring Data (trend data sets). The StreamNet Program anticipates the need to refine and/or expand the StreamNet DES in future years to accommodate the data needs for the NPCC 2020 Addendum. These edits include, improving the quality of bull trout data, and, additional data categories such as results from snorkeling, rotary screw trap, or electrofishing sampling recommended by the FMWG Task teams.

The StreamNet Application Programming Interface (API) requires that users request access and are issued a unique programming key to interact with Fish Monitoring Data via this method. The API is primarily used to submit records to StreamNet, and the use of unique programming key is a case of programming best practice rather than limiting data access.

E. Maintenance and Access to GIS Layers

Work Elements:	160: StreamNet maintaining and enhancing data management 161 GIS Data and Metadata

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 locations and 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 although the need to support these other facilities is being discussed given the information needs of NPCC and BPA.

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. The web map services that fuel StreamNet's mapping applications can also be leveraged directly by users with a desktop GIS and by partners that wish to incorporate the layers into their own web applications. All of StreamNet's core data layers are available for download in file geodatabase format and include ISO compliant metadata.

PSMFC's GIS Center staff maintain and update StreamNet's core GIS layers as new data become available from partners. In general, the GIS Center staff checks about twice a year for available updates from partner agencies. The PSMFC GIS Center staff participate in the FMWG task teams to provide guidance on recommendations that include GIS layers managed by PSMFC for StreamNet. One of these task teams, the Fish Population Names and GIS Boundaries Task that was initiated in 2021, is being co-lead by the PSMFC GIS Manager to develop a standardized approach for how fish management units (or population names) and boundaries are defined for display on StreamNet tools. This work is also informing preliminary layers being developed during 2023 to support CBFIsh.org.

F. CAP Fish HLIs

Work Elements:	159: DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX) 159: CAP Fish HLI (CAX) – DES, API, Database 160: StreamNet maintaining and enhancing data management 161: Improving data sharing with and access from StreamNet Data Systems

CAP Fish HLIs for population level estimates are available through CAP Fish HLIs queries (CAX data system[xxi]). Development of CAP Fish HLIs queries (renamed in 2021, formerly named Coordinated Assessments Indicators of Fish Population Health or CAX Query) was initiated in 2016 with the intent of providing access to HLIs and related (or associated) trends which are housed in the FMD (trends) system. CAP Fish HLIs query 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 CAP which follows the Five-year Plan for CAP. This technical guidance includes development and modifications to the Data Exchange Standard (DES) document which is needed for submitting standardized data that will be displayed on the CAP Query. The DES document 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 document 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 are hosted by the originating agency, and exchanged following the DESs using the StreamNet Application Programming Interface (API).

As part of the CAP, staff at PSMFC and along with others participating in CAP coordinate 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 API facilitates submittal and access of CAP Fish HLIs through the CAX data system. CAP Fish HLIs and supporting time series data sets in the Fish Monitoring Data query 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.

Users accessing data through the CAP Fish HLIs queries are also required to agree to the Data Use Agreement (renamed from EULA to Data User Agreement in 2022 to accurately fit the content) at the request of data submitting agencies. The Data Use Agreement reflects the data sharing agreement conditions agreed to by parties providing data to StreamNet for the CAX data 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 CAP Fish HLIs query 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 at 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:	159: DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX)

Data exchange standards, a data sharing agreement, and rigorous QA/QC protocols are all part of the data compilation and reporting process (see Data Exchange Tools webpage and StreamNet Quality Assurance and Quality Control Plan version February 7, 2022. Data, including reference documents, in the StreamNet and CAX databases must conform to the StreamNet DES and CA HLI DES documents, 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 document 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 document 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 (see the latest version from the CAP DDT document table Data Exchange Standard Development and Revision Procedures for details).

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 three levels. 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 is submitted that says it is for "spring run coho salmon," the record is rejected because there is no such run. The third level of validation looks for data problems between rows of data within a table. This third level prevents duplicate data by enforcing all candidate keys for a table. 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, changing existing records, and deleting existing records. The QA/QC procedures implemented pre, during and post submittal were updated and agreed to in the final 2022 version: StreamNet Quality Assurance and Quality Control Plan version February 7, 2022.

H. Enhanced Metadata Documentation by Connecting to Complementary Data Systems

Work Elements:	160: Infrastructure/equipment and base operations 160: Metadata Documentation

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 them. During 2022, StreamNet continued to work on improving the quality of metadata associated with its data records while exploring approaches to reduce the burden on the data provider. Initial work discussing how to leverage documentation of protocols and methods available from other regional data systems (e.g. MonitoringResources.org and CBFish.org) began in 2021 and the StreamNet Technical Team decided to focus on the connection with the Fish Monitoring Data system during 2022. The availability and quality of metadata varies depending on the year the data was collected (older data sets tend to have lower quality metadata) and the documentation requirement associated with the data collection event. At a minimum, StreamNet has gathered the source document or report that detailed the protocols used to collect these data and, working in collaboration with Library 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 these data, a tool to support full description of methods and protocols was developed through PNAMP (MonitoringResources.org; BPA project #2004-002-00) with support from BPA. In the absence of metadata provided by the Library and/or MonitoringResources.org, the StreamNet database will at a minimum point to the originating agency as the source.

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 for Fish Monitoring Data – 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 for various reasons. Depending on the data being submitted, different levels of metadata are captured. Currently, for the data submitted to the StreamNet Fish Monitoring Data (trends) database that are not related to CAP Fish HLIs 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 CBF&W Library's cloud server. Library created URLs for these source documents are presented with all views of the data and with all data downloads. Many source documents contain methods sections that provide 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. As of February, 2023, approximately 10,900 documents have been reconciled and the projected completion date is December 2024. Initial work exploring how to leverage documentation of protocols and methods available from other regional data systems (e.g. MonitoringResources.org and CBFish.org) began in 2021 and further work was performed by a subgroup of the StreamNet Technical Team during 2022 to explore options to improve this connection. Options for moving forward with improving the connection between StreamNet and MonitoringResources.org are to be discussed with the StreamNet Steering Committee in 2023.

CAP Fish HLIs – Metadata fields are associated with the data submitted for CAP Fish HLIs estimates, and the Fish Monitoring Data trends data sets related to populations with HLIs estimates, that are displayed on the CAP Fish HLIs queries. Some of this metadata content includes URLs that link protocols and methods that are publicly available such as on the data providers website, CBF&W Library and/or on www.monitoringresources.org, where information on the specific method used for a particular component of data related to population-scale HLIs are documented. Details on the specific metadata fields can be reviewed in the CA DES. The metadata information is fully downloaded along with any exported data from the CAP Fish HLIs, and portions of the metadata information are included along with the data on the CAP Fish HLIs queries.

1. PNAMP MonitoringResources.org

In 2008, PNAMP began efforts that lead to the development of MonitoringResources.org. PNAMP leveraged work by National Park Service, US Bureau of Reclamation, and USDA Forest Service that 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 Research, Monitoring and Evaluation (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 for design and documentation of monitoring projects from beginning to end[xxiv].

The StreamNet database contains a field associated with the CAP Fish HLIs 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. Work initiated in 2021 is exploring how to improve the use of content in MonitoringResources.org by facilitating the connections with the StreamNet data systems.

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). To better reflect the scope of the project, the Library was renamed Columbia Basin Fish & Wildlife Library in 2020 and, in 2021, changed the Library's website domain from streamnetlibrary.org to cbfwl.org 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, the Library continues to prioritize making StreamNet source reference documents easily accessible through the Library catalog and ensuring their long-term preservation. In 2022, the Library received 102 new StreamNet source reference documents. These documents were assigned a URL and appropriate metadata, and made accessible through the Library catalog.

I. Data Backup Systems

Work Elements:	159: Transfer of data to secure and accessible repositories 160: Infrastructure/equipment 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 store these offsite. Additionally, StreamNet staff send a differential backup to the cloud on a daily basis.

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

Work Elements:	189: Coordination and Outreach 161: Reporting and Decision-Making Processes

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 workload placed on individual biologists and data stewards 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 (ITMD) project (BPA Project #2008-507-00) to integrate these two projects, along with the Columbia Basin Fish & Wildlife Library (BPA Project # 2008-505-00), to maximize data discovery and sharing. Much of the data flow during 2022 from the tribes was through a StreamNet member state agency who collaborated with a tribe to collect and process data. Starting in late 2019 and through 2022, Nez Perce Tribe (NPT) and the YNF have submitted data to Coordinated Assessments, such as NOSA/escapement and Juvenile outmigrants. It is expected that other CRITFC tribes will be providing their data directly to StreamNet, as those tribes develop the capability to share data with regional repositories. ITMD Project Staff and group members participate in StreamNet and CAX planning and development tasks.

The ITMD Project is the only mainstem Columbia River Basin data project that serves as a forum for CRITFC member tribes to coordinate and collaborate as they develop best practices for data management strategies. ITMD Project members comprise approximately 25 data and GIS professionals who are partially funded by the ITMD Project and are positioned at each tribe. Similar to coordination work done through the StreamNet project and PNAMP.org, coordination enables the tribal data professionals to leverage expertise and resources to develop centralized database systems (CDMSs or Yakama Nation's Information Management System/Status and Trends Annual Report-IMS/STAR), data management strategies, data flow between regional and tribal data repositories, and innovative data collection, storage, and access techniques. The project scope is to serve as a forum for collaboration, coordination and as a liaison for other regional partnerships, but the Project does not house or manage any data. Collaboration occurs via monthly conference calls, educational webinars, and an annual workshop. Project members participate in frequent small group meetings such as for CDMS/GitHub technical meet-ups, and in the Indigenous Data Sovereignty work group. Many ITMD and tribal staff attend many regional coordination meetings for data management and sharing within the Basin, but if tribal staff are not able to attend, the ITMD Project staff serves as liaison between regional agencies, entities, and the tribal data professionals regarding data management and data product requirements. ITMD Project staff participate in meetings and conferences in the Columbia Basin including Coordinated Assessments Workshops and Working Groups, StreamNet Executive Committee, StreamNet Steering Committee, CAP Core Team, StreamNet Technical Team, CAP DDT, the Tribal Exchange Network Group, and PNAMP Fish Monitoring Workgroup that are directly involved in improving Coordinated Assessments. More information about the ITMD Project is available in their Five-Year Strategic Plan: 2022-2026[xxv] and in their Annual Reports.

2. Fish Passage Center's Comparative Survival Study Database

The Fish Passage Center (FPC, 1994-033-00) provides technical analysis, data summaries, and 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 CAP format, and upload these into the CAX.

3. US. Fish and Wildlife Service Database

The USFWS received 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 (FAC) in Oregon, Washington, and Idaho collect data at 14 National Fish Hatcheries (NFHs). Those data are currently stored in two different databases (CRIS and FINS) that possess different structures. The FAC staff in Oregon and Washington are in the process of evaluating database options that will improve the efficiency of managing those data, which will substantially improve the ability to share NFH data with StreamNet partners in a timelier fashion. The NFHs in Idaho will continue to use the FINS database.

V. Results – Improved Data Sharing and Access

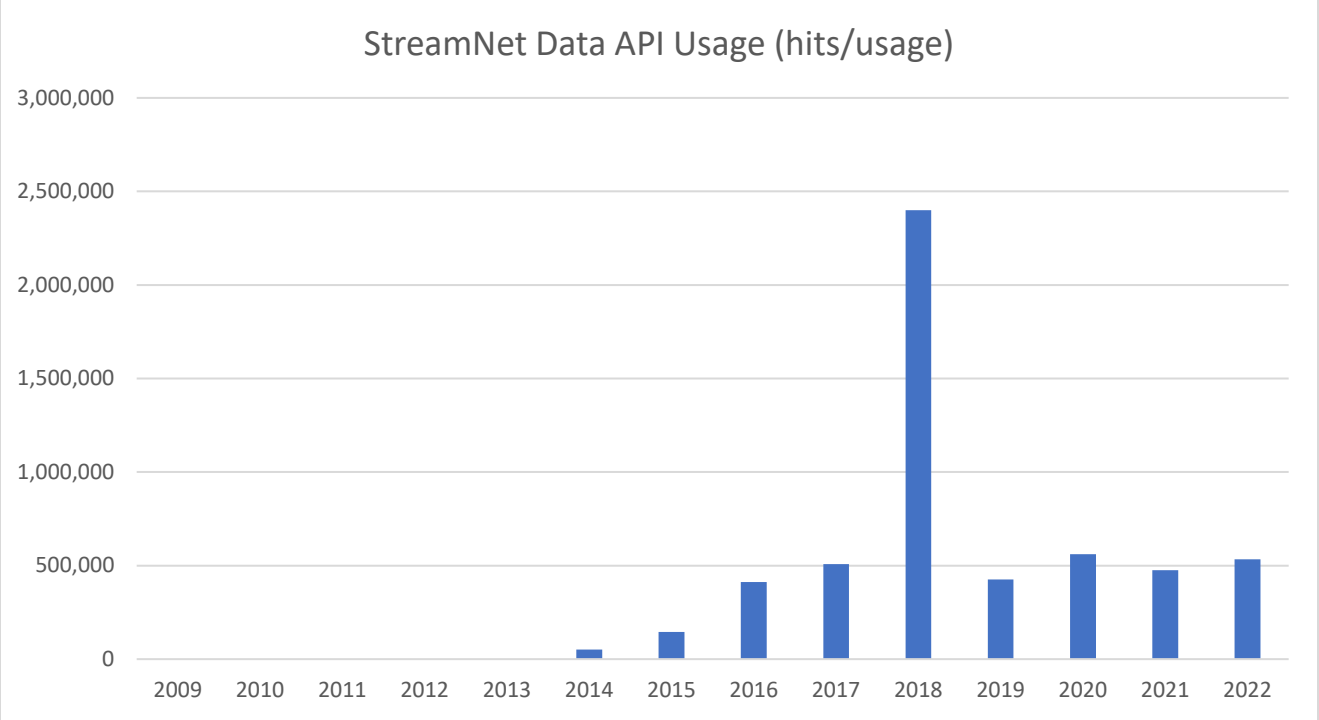
Work Elements:	159: Support transfer of data into secure and accessible repositories 161: Data – dissemination 189: Coordination

StreamNet continued to acquire fish data from our four partner state fish and wildlife agencies (ODFW, WDFW, IDFG, and MFWP) and our tribal partner (Colville Tribes). StreamNet continues to work with other data providers, including one federal agency (USFWS for data from the national fish hatcheries), the Shoshone-Bannock Tribes, a tribal consortium (CRITFC[1]), and the Fish passage Center (FPC), to facilitate access to population-level indicator data for the CAP Fish HLIs. The Shoshone-Bannock Tribes successfully submitted data to the CAP Fish HLIs for the first time in 2020. These data have been collected and analyzed using a variety of funding processes and sources, only some of which are funded 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. The BPA statement of work and work element summary that guide the work performed by StreamNet PSMFC and its partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) are provided in Appendix C.

Data submitted to StreamNet are available through multiple web-based data query tools (tabular and map based) as well as multiple data download formats. All data are available to the public from the web tools. Some partners are also provided with "read-only" access through the StreamNet API as recommended by programming best practices, such as NOAA, and to support NPCC and BPA tools. StreamNet metadata are also provided online as web services. StreamNet harvests its own web services as part of the new, more efficient approach to querying our data. 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 CAP Fish HLIs query system are also required to agree to the Data Use Agreement (renamed from EULA to Data User Agreement in 2022 to accurately fit the content) at the request of data submitting agencies.

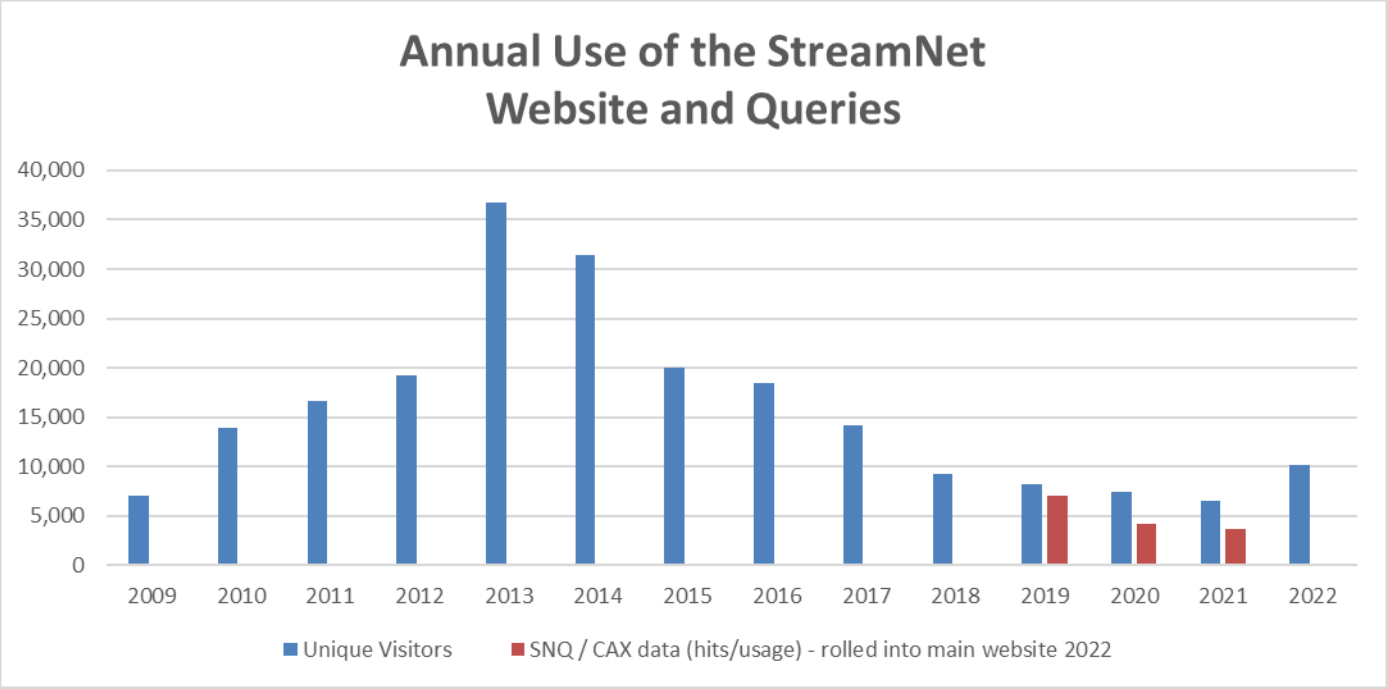
Use of the API to submit and access data on the StreamNet database has continued to increase since the API became available in 2014 (Figure 8a). Recent improvements to the API have led to more partners using the API instead of the StreamNet website. One recent improvement to the API that was completed 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 (Figure 8b), because the API is addressing more of the data submitters' and data users' needs. (Figure 8a and 8b; 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.



Note: The increase in API usage shown 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 2021 and 2022 the API use is reflective of a more normal level of use.

Figure 8a: *shows the annual count of times the API was used to submit/use data (2014-2022). Although the y-axis scale differs between 8(a) and (b) one can see that as the use of StreamNet API (8a) increased over time there was a corresponding decrease in the query systems (8b).*



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

Figure 8b: *illustrates the number of times during 2022 that StreamNet's Fish Monitoring Data query (trends) and the CAP Fish HLIs query (CAX) systems (no pre-2019 data available) were used to access data as well as the total number of unique visitors to the StreamNet website. The decrease in website access reflects the shift to using the API for data exchange and verifications.*

In 2021 the StreamNet website reorganized the content by broad categories so that data and tools were more easily located by the user. Per 2022 analytics, 10,100 unique users visited the website with 73% of these using a desktop to access the website (See appendix VII).

StreamNet GIS data are published as downloadable spatial data and as publicly accessible web map services. StreamNet GIS data set downloads account for about 33% to 49% of all GIS data sets downloaded from PSMFC (Figure 9). In general, those who download StreamNet's GIS data are associated with IP addresses from academia, agencies, non-profits, private consultants, and the general public (Figure 9). Use of StreamNet's interactive mapping applications has gradually increased over time, but appears to be leveling off, and the StreamNet Mapper continues to be the most frequently used (Figure 10).

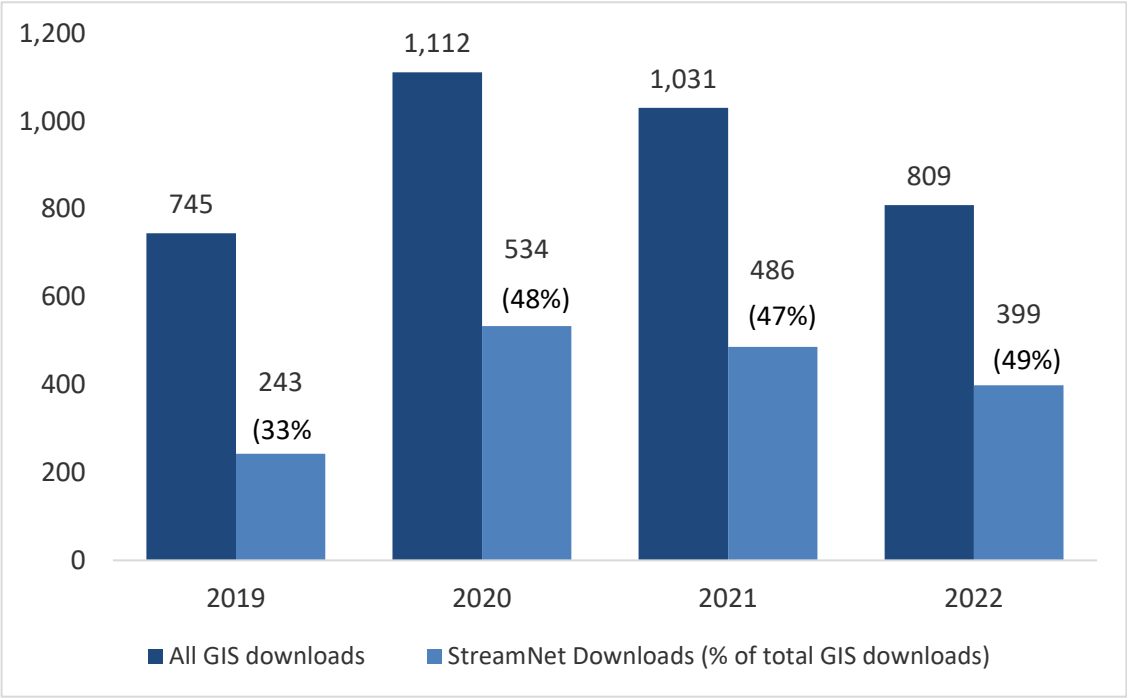


Figure 7: StreamNet's GIS data sets represented about 47% of all GIS data sets downloaded from PSMFC in 2022.

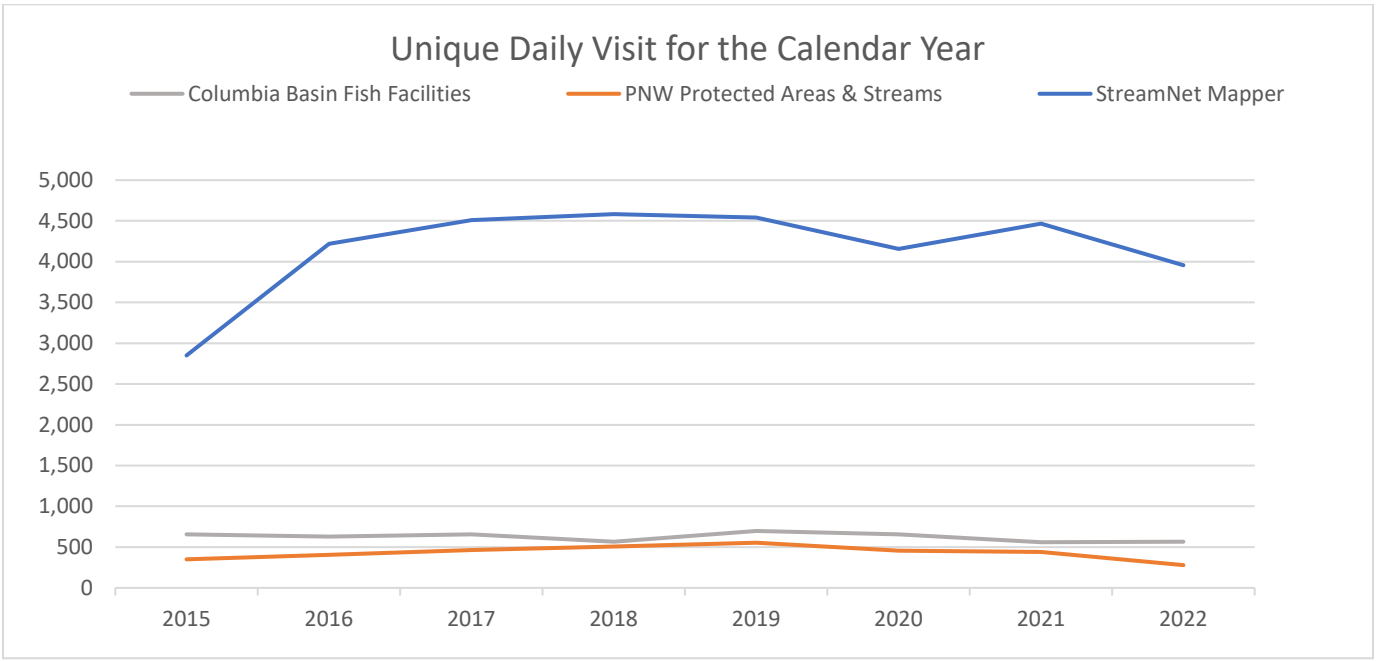


Figure 8: Use of StreamNet's online mapping applications has remained relatively flat, with the total annual unique daily user sessions increasing between 2015 and 2022. A unique daily visit is sometimes referred to as a 'session' in web analytics terms. All StreamNet web mapping applications that are currently in use were published on the ArcGIS platform as of 3/1/2015, and thus the data during the 2015 to 2022 period uses comparable web analytics for reporting unique users. Web analytics for prior applications are different in nature and are not comparable. Note that usage reports generated from ArcGIS Online, 2015 statistics are not for the entire year (3/1/2015 - 12/31/2015).

A. StreamNet Data Stewards within Agencies – Enhancing Data Access

Work Elements:	159: DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX) 159: Transfer of data to secure and accessible repositories 159: CAP Fish HLI (CAX) – DES, API, Database 159: Fish Monitoring Data (Trends) – DES, API, Database 160: StreamNet maintaining and enhancing data management 160: Implement and participate in processes described in the StreamNet QA/QC 189: Supporting Data Requests

StreamNet continued to coordinate within partner state agencies and the Colville Tribes as they improve and expand their systems to support broader regional data sharing. The StreamNet subprojects in the state agencies and the Colville Tribes all contributed to development or improvement of their organizations' data storage systems in 2022. StreamNet-funded data stewards 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 focus continues to be on increasing the speed and efficiency of data conversion to the regional standard StreamNet DES, and then submission of data and related GIS information to StreamNet. Because each partner uses different approaches to their data management, actions taken by the subprojects differ accordingly.

In addition to the StreamNet funded data stewards, StreamNet supports advancing data management and sharing capacity with other data providing tribes to improve their internal data flow and support regional needs. During CY2022 StreamNet secured additional funding from an internal IJFA grant, which allowed StreamNet to continue providing funding to the Shoshone Bannock Tribes to support their ongoing efforts to improve their tribal data management and sharing capacity.

During 2022, as outlined in the StreamNet Quality Assurance and Quality Control Plan version February 7, 2022, PSMFC StreamNet and the StreamNet funded data stewards implemented a pilot QC visual check process using a custom QA web-application to track records reviewed and errors detected. The outcome of this pilot was discussed during the fall 2022 StreamNet Steering Committee meeting, during which it was decided that the QA web application would be refined to capture additional metrics for records reviewed during 2023, and that this second year would further inform what adjustments need to be made to ensure that the QC visual check during out-years is value added. A subset of data stewards worked with PSMFC StreamNet to recommended the modifications to the QA web application that is being discussed with the StreamNet Steering Committee during its winter 2023 meeting prior to initiating the second year of the pilot.

As improvements continue to be made within data providers' data flow and in their exchange with StreamNet, more have either achieved, or are making substantial progress towards, submitting data directly into StreamNet databases through automated means. PSMFC StreamNet continues to encourage integration of the StreamNet API and data validation system into agency processes and programs. As efficiencies are gained through implementation of a streamlined data flow, data stewards should be able to shift to additional regionally important data categories or data sets.

1. The Confederated Tribes of the Colville Reservation

In 2022 the Data Steward maintained and updated the Okanogan Basin Monitoring and Evaluation Program (OBMEP) database, and further automated HLI calculations. The end goal is to have all data and most calculations housed in the OBMEP database. By moving calculations from spreadsheets to SQL views (scripts), no time is spent updating/running spreadsheets and uploading results to the database, thus reducing the opportunity of human error and reducing the workload on biologists.

The Colville Tribes reviewed and provided comments to proposed QA/QC protocols and will implement them. The Colville Tribes also participated in the QC Visual Check and provided input on refining the QA web-application for the 2023 implementation

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 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 Chinook, steelhead, sockeye, and Chinook index redd counts.

IDFG StreamNet Staff continue to use the Manual QAQC protocols in order to ensure completeness and correctness of the data. IDFG StreamNet Staff also participated in the QC Visual Check and provided input on refining the QA web-application for the 2023 implementation

3. Montana Department of Fish, Wildlife & Parks

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 time hand entering historic data into the system. StreamNet staff are continuing to be a resource to biologists as well as advocates of biologists entering their data into the system. The database currently houses over 7.6 million raw fish records statewide (up from 5.3 million). In 2022, 328 fish survey locations were added in the Columbia Basin resulting in 67,519 individual fish records. Statewide, 795 new survey locations were added resulting in 146,842 individual raw fish records being added to the database. In the Columbia Basin 113 redd counts at 113 locations, which identified 1109 redds, were added to the database during 2022. All relevant data were submitted to StreamNet databases or the Data Store.

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' native range. Discussions were held related to integrating the Yellowstone Cutthroat Trout native trout assessment into the Inland Cutthroat Protocol (ICP) data system. There is potential to revive this project in the future though it is dependent on range-wide priorities and funding.

During the calendar year, MFWP StreamNet staff developed an ArcGIS Online map viewer for BPA staff to view Montana's fisheries data more easily. Data displayed in the map viewer includes fish distribution, spawning surveys, habitat data, fish surveys, temperature data (when available) and watersheds.

Large agency projects continue to occupy MFWP's Application Development and Projects Bureau staff time. These staff are not funded with StreamNet dollars. This has resulted in no opportunity for development work on the internal database during 2022.

MFWP StreamNet Staff reviewed and provided comments to proposed QAQC protocols and will implement them. MFWP StreamNet staff also participated in the QC Visual Check and provided input on refining the QA web-application for the 2023 implementation

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. We continue to encourage the implementation of data management best practices related to standards in field and file names, metadata, directory organization, data sharing and non-disclosure agreements and data management plans, as time and resources allow, particularly as they relate to priority CA and Recovery Planning efforts.

StreamNet staff spent considerable time designing new tables, implementing improvements to existing tables, and testing, validating, and approving the results in ODFW Fish Monitoring and Data Distribution database and web applications for Coordinated Assessments and Fish Monitoring Data (FMD) (trends). The Trend Evaluation, Validation, and Submission (TEVaS) and Coordinated Assessments Validation, Evaluation and Submission (CAVES) internal web applications were fully operational for StreamNet data exchange standard (DES) tables. These applications continue to be used to submit ODFW Coordinated Assessment and Trend data via the StreamNet API. In addition, two Coordinated Assessment tables and three Trend tables not previously managed by CAVES and TEVaS were added to the applications. In 2023, staff anticipate working on the Hatchery Coordinated Assessments DES tables and added the remaining tables for PNI, Age, and Hatchery Returns.

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 and updated. During the year, 708 new and existing DC records were created and updated by Natural Resource Information Management Program (NRIMP)/StreamNet staff, ODFW staff, and external entities (i.e., watershed councils). In 2022, using partial funding from other sources and staff in district offices, we continued an effort to improve the accuracy of records from the old ODFW Library electronic bibliography in the DC to preserve this historic record of ODFW documents and provide access to digital copies.

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 and efficient exchange of CA and Recovery data to StreamNet and the ODFW Salmon & Steelhead Recovery Tracker. In 2022, with other funding, Oregon updated and submitted coastal coho natural origin spawner abundance, adult recruits per spawner, and parr abundance estimates to StreamNet. Recovery populations in the Lower Columbia, Middle Columbia, Snake River and Coast coho (other funding) data were also processed and uploaded to the ODFW Recovery Tracker public website (http://odfwrecoverytracker.org/).

StreamNet supported the proposal to develop the Oregon Salmon Recovery Tracker website 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. The system was targeted to undergo major technical updates in 2020 but has been postponed as we develop design specifications, which will be complete early in 2023. We also anticipate the new or updated application will be completed in 2023.

Various programs within ODFW are beginning to incorporate electronic data collection methods such as ArcGIS Survey 123 into their programs which can streamline the process of getting data from field collection to making data available for processing and analysis.

Stakeholders continued using the Fish Habitat Distribution (FHD) Data Change Request (DCR) form web application developed by ODFW NRIMP GIS staff. This form enables FHD stakeholders to submit proposed changes to the FHD data and to improve upon its accuracy and completeness. Using other funding, ODFW was able to hire a technician to incorporate appropriate changes into the Oregon Fish Habitat Distribution dataset. Keeping this information updated is crucial to the quality of Oregon FHD data submitted to StreamNet.

Oregon StreamNet's server infrastructure continued to be monitored and upgraded where necessary for long-term support. Software tools used for development were upgraded to their most recent versions. Capacity of the infrastructure continued to be monitored and is currently adequate at least through 2024.

ODFW staff reviewed and provided feedback to PSMFC StreamNet on the final Quality Assurance Quality Control Plan (QAQC) (adopted 2022). Staff referred to the document throughout the year while updating or adding new records, giving particular attention to updating metadata, such as, fields for methods, URLs, and comments.

ODFW also participated in the pilot StreamNet QA/QC records review of Coordinated Assessments data. Staff reviewed the data fields and values in random record sets, the CAX Map Query, and the HLI Tabular Query. We also completed the data compiler review section, and provided reviewer notes, submitting them to PSMFC StreamNet for future discussions on implementation.

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.

WDFW StreamNet Staff reviewed and provided comments to proposed QAQC protocols and will implement them. WDFW StreamNet staff also participated in the QC Visual Check and provided input on refining the QA web-application for the 2023 implementation

B. Data Store - Archived Data Sets and Information

Work Elements:	159: Transfer of data to secure and accessible repositories 161: Improving data sharing with and access from StreamNet Data Systems

The StreamNet Data Store serves as the default database for numerous fish population metrics such as fish habitat, and abundance. As recommended in the 2013 BPA Data Management Strategy[2] the Data Store is a repository for any BPA projects where a BPA recognized environmental data repository is not available, and 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. 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. In general, StreamNet partners encourage BPA project sponsors to secure data in repositories, including the Data Store. The Data Store also supports the Data Management principles of the 2014 Columbia River Basin Fish and Wildlife Program's Adaptive Management[3].

During 2022, StreamNet staff continued to provide support by phone and email for data contributors to the Data Store, including BPA and non-BPA funded contributors. Eight new data sets were added to the StreamNet Data Store, and seven existing data sets were updated, during calendar year 2022. The following organizations provided the data sets to the StreamNet Data Store: Methow Salmon Recovery Foundation (1 data set); Montana Fish, Wildlife & Parks (2 data sets); Nez Perce Tribe (1 data set); PSMFC contractors for the NMFS MAFAC Columbia Basin Partnership (1 data set); Shoshone-Bannock Tribes (1 data set); US Geological Survey (7 data sets); and Washington Department of Fish and Wildlife (2 data sets). Some of the BPA funded CHaMP project data sets (channel units and site summary data) were added to the Data Store in CY2020.

PSMFC also physically hosts other data storage and file repositories as a cooperator with state and tribal agencies, including:

CHaMP – in 2022 StreamNet was asked by BPA to provide access to archived information from the Columbia Habitat Monitoring Program (CHaMP). To address this request StreamNet added a new CHaMP webpage to its website and included a CHaMP Data File Explorer to facilitate searching and downloading the CHaMP data files. The content of the File Explorer represents 687,030 files totaling 776 GB, along with documents from the CHaMP project. This extensive data set includes photographs, stream topography, and stream temperatures for the years 2011 through 2018 at all CHaMP monitoring subbasins. The Data Store submission from 2020 contains summary data for stream discharge, light, macroinvertebrates, stream substrate, vegetation, and water quality that are not part of the 2022 data set. StreamNet expects additional documents and datasets to be transferred from Environmental Services Associates' (ESA, formally Sitka Technology Group) champmonitoring.org to be archived on the StreamNet's CHaMP webpage in the next several years

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[xxvi].

[2] Bonneville Power Administration. 2013. A Framework for the Fish and Wildlife Program Data Management: Issues and Policy Direction for Development of a Data Management Strategy and Action Plan. Bonneville Power Administration, Fish and Wildlife Policy and Planning Division, June 04, 2013.

[3] Northwest Power and Conservation Council. 2014.2014/2020 Columbia River Basin Fish and Wildlife Program. Council Document 2014-12, revised 2020. Portland, Oregon. https://www.nwcouncil.org/sites/default/files/2014-12_1.pdf

HSRG – StreamNet continues to provide access to the HSRG content that was archived on the StreamNet website during 2021 with the assistance of the Library. 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[xxvii].

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.

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

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 population surveys, and genetic sample information to the StreamNet Data Store as independent datasets.

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, including the ODFW Data Clearinghouse and StreamNet.

5. Washington Department of Fish and Wildlife

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

C. Fish Monitoring Data (trends)

Work Elements:	159: DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX) 159: Fish Monitoring Data (Trends) – DES, API, Database 160: StreamNet maintaining and enhancing data management 161: Improving data sharing with and access from StreamNet Data Systems

StreamNet's Fish Monitoring Data new tabular query released in 2020 was designed so that users can quickly find and access the data they are looking for by using filters. Once located, the users can view the table of data along with metadata and a map of the monitoring location. The user can also choose to download these data into an Excel spreadsheet file or copy the URL to easy reference and share these data with others. The Fish Monitoring Data tabular query pulls data using the API and was designed to better integrate with the StreamNet website. Improvements to the Fish Monitoring Data query was initiated in 2021 to improve access to age data, and that work continued during 2022. Some of the improvements completed include the addition of population and stream name filters.

Updating trend data sets was prioritized by the StreamNet Executive Committee in 2018, with emphasis on trends supporting CAP Fish HLIs and NPCC reporting tools. With the recently adopted 2020 Addendum to the Columbia River Basin Fish and Wildlife Program, it is anticipated that the Fish Monitoring Data query will be supporting specific data needs for the NPCC's Program Tracker. The specific data are still to be determined and progress is expected in 2023 as the NPCC have made progress in identifying data to be displayed in the NPCC Program Tracker.

The 2020 version of the StreamNet DES, which contains data submission standards for fish monitoring data, continued to be used in 2022.

A summary of the Fish Monitoring Data trends data sets updated in CY2022 is provided in the below table (Table 7) along with a highlight of the number of records associated with CAP Fish HLIs (Table 8).

Table 7: Summary of the number of time series data sets in the Fish Monitoring Data (trends) and Protected Areas records in the StreamNet database, by data category. This summary represents all data submitted by the end of calendar year 2022 from any geographic areas in Montana, Idaho, Washington, and Oregon (not limited to the Columbia River basin). The number of trends in 2022 equaled 18,164 data sets consisting of 190,620 observations. 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 2022 (2021)	Years 2022 (2021)	Observations 2022 (2021)
Redd counts	5,057 trends (5,049 trends)	1901 – 2022 (1901 – 2021)	56,443 (55,788)
Fish counts	444 trends (442 trends)	1956 – 2022 (1956 – 2020)	2,676 (2,491)
Spawner counts	5,107 trends (5,112 trends)	1944 – 2021 (1944 – 2021)	39,877 (39,216)
Spawning population estimates	3,116 trends (3,116 trends)	1901 – 2021 (1901 – 2021)	21,081 (20,964)
Dam / weir counts	521 trends (515 trends)	1926 – 2022 (1926 – 2021)	14,706 (14,516)
Fish abundance estimates	126 trends (126 trends)	1976 – 2022 (1976 – 2020)	1,236 (1,215)
Hatchery returns	1,088 trends (1,087 trends)	1906 – 2022 (1906 – 2021)	10,548 (10,534)
Freshwater harvest	2,705 trends (2,705 trends)	1894 – 2021 (1894 – 2020)	46,053 (46,022)
Protected Areas	32,997 records	n/a	n/a

Table 8: Summary of Coordinated Assessments Partnership populations with associated time series data sets in the Fish Monitoring Data (trends) as of 12/31/2022. First column is population grouping; second column is the type of data; third column is number of extant populations (includes superpopulations) with associated time series data sets in the Fish Monitoring Data (trends) for the population group and data category indicated; fourth column is the year range for the trends; fifth column is the number of records of data in the group. Fish Monitoring Data time series data (Trends) data are generally at a smaller geographic scale than populations and are generally indexes of abundance.

Population Group	Data Category	Pops	Years	Records
Population of interest*	Redd counts	53	1947 - 2022	16,153
	Fish counts	15	1994 - 2022	1,043
	Spawner counts	15	1985 - 2021	4,969
	Spawning population estimates	9	1954 - 2021	1,419
	Dam / weir counts	11	1963 - 2022	458
	Fish abundance estimates	10	1996 - 2022	365
	Hatchery returns	13	1978 - 2022	508
	Freshwater harvest	8	1894 - 2020	548
Columbia River Basin	Redd counts	95	1947 - 2022	22,958
	Fish counts	22	1994 - 2022	1,900
	Spawner counts	51	1948 - 2021	11,811
	Spawning population estimates	44	1944 - 2021	4,089
	Dam / weir counts	31	1928 - 2022	2,474
	Fish abundance estimates	13	1996 - 2022	513
	Hatchery returns	32	1942 - 2022	835
	Freshwater harvest	21	1894 - 2020	1,052
Oregon Coast	Spawner counts	72	1950 - 2021	8,656
	Dam / weir counts	5	1946 - 2021	138
Puget Sound	Spawner counts	0	--	0
	Spawning population estimates	0	--	0
	Dam / weir counts	0	--	0
	Fish abundance estimates	0	--	0

[*]Population of interest = The 68 BPA Tier 1 and Tier 2 priority populations identified during 2015 by BPA to support their reporting requirements under the Federal Columbia River Power System Biological Opinion. These are now referred to by StreamNet as "populations of interest."

Columbia River Basin = All population within the Columbia Basin, including the 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.

Puget Sound = Populations in Washington draining into Puget Sound / Strait of Juan de Fuca. These are outside the Columbia River Basin. Data sets were removed in 2021 pending further discussion between WDFW and Puget Sound tribes as to which data sets could be exchanged with StreamNet.

1. The Confederated Tribes of the Colville Reservation

The Colville Tribes compiled related trends data for Summer Chinook and uploaded them to StreamNet.

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 113 redd counts at 113 locations in the Columbia Basin which identified 1109 redds. 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 the submission included all fish distribution records in the MFWP dataset to ensure StreamNet has a comprehensive and current dataset.

4. Oregon Department of Fish and Wildlife

Oregon utilized the Trend Evaluation, Validation, and Submission (TEVaS) internal web application to exchange 6 new and 791 updates to existing traditional trends (including updating and adding 646 records for escapement data only) and 40 new and 15 updates to existing references via the StreamNet API. The submissions originated from BPA-funded projects, NPCC dashboards, opportunistic connections to CA data, populations of interest within the Columbia Basin, fish habitat distribution, and QC information from StreamNet staff. Staff submitted a new trend series for a population of Lower John Day River fall Chinook redd counts.

5. Washington Department of Fish and Wildlife

WDFW StreamNet staff continue to update HLIs for existing populations for Lower and Upper Columbia populations. As well as update any corresponding trend data.

Okanogan Spring Chinook datasets (NOSA and Trend data) were taken over by Colville Tribe staff to populate.

WDFW updated Columbia Basin trend data and HLIs for existing populations for Upper Columbia populations.

Lower Columbia data submissions consisted of HLIs for existing populations, as well as continue to update corresponding trend data.

D. GIS Layers Updated Content and Access

Work Elements:	160: StreamNet maintaining and enhancing data management 161: GIS Data and Metadata

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 CAP during 2021. Since BPA reinstated funding to support PSMFC GIS center's StreamNet related task in 2020, the GIS center has engaged in FMWG task groups to advance development of polygons for focal species in a standardized manner that includes manager input, has assisted in improving connections between queries and GIS tools, and is working with StreamNet to improve use of PSMFC GIS layers in NPCC, PNAMP, and BPA tools. Some of the GIS funding provided by BPA is also being applied to scoping new data integration tools, such as a screw trap dashboard that pulls information from multiple regional data systems and its ESRI dashboard prototype version was reviewed in 2022 by BPA staff to inform further development in 2023.

PSMFC StreamNet's Regional StreamNet also provides links to barrier data sets that partner agencies publish publicly. These barriers data are not currently being compiled and standardized 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, StreamNet partners are often involved in maintaining these datasets to meet internal state mandates and to inform the fish distribution dataset.

StreamNet's regional GIS Datasets including fish distribution and population boundary datasets are packaged for download and made available on the project website. In addition, spatial data are published as web map services that can be queried and leveraged by project partners via PSMFC's ESRI REST Services endpoint (https://maps.psmfc.org/server/rest/services/StreamNet). In the coming year, we plan to improve the visibility of this resource and actively coordinate with BPA, NPCC and PNAMP to facilitate use through PSMFC's Enterprise GIS and ArcGIS Online.

The following regional GIS Datasets were updated based on partner data submissions:

- Fish Facilities (updated ~quarterly, mostly edits & additions from PTAGIS)
- Sampling locations/trends (updated as needed, attribute updates are processed via the StreamNet API)
- Fish Distribution (updated as needed, submission received from MFWP in late 2020 were included in the latest dataset and we anticipate receiving an update from most partners in 2023.)
- Population Boundaries (updates/additions of non-TRT populations as needed, attribute updates are processed via the StreamNet/CAP API)

The GIS center has also been engaged in identifying GIS layers needed to support specific BPA tasks, including:

- Assessing which GIS layers for focal species are needed to support CBFish.org functionalities, which is ongoing in 2023.
- Discussing with PNAMP MonitoringResources.org which PSMFC GIS layers they would want to include and how to make these easily accessible to them.

1. The Confederated Tribes of the Colville Reservation

GIS related tasks are not included in the StreamNet scope of work for the Colville Tribes, though information on the layout of the research (assessment units, reaches, sites) and location of fish facilities is available in an interactive map on the site okanoganmonitoring.org.

2. Idaho Department of Fish and Game

The generalized fish distribution layer was updated per new stream and lake survey data via direct GIS Exchange with StreamNet. The Fish Facilities layer was updated per input from IDFG fisheries staff.

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 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 additional 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, data dashboards and Story Maps.

4. Oregon Department of Fish and Wildlife

Within Oregon, routine GIS coordination occurred during 2022, as well as maintaining hydrography data (whole stream routes) to support mapping trend data. Staff coordinated with the ODFW GIS Coordinator to add updated fish observation data and review changes to the Fish Habitat Distribution (FHD) Database. All fish habitat distribution datasets (except for Coastal Cutthroat Trout) were synchronized to the December 2021 NHD. Updates from ODFW

monitoring projects, fish districts and the BLM were incorporated into both anadromous and resident salmonid datasets. Updated fish habitat distribution data were published to the ODFW Data Clearinghouse in October 2022. The updated data informs potential changes to the primary use of the fish habitat designations (spawning, rearing, migration etc.) and/or to the 'Basis' which tracks whether the feature is based on a fish observation, habitat observation, professional opinion, or modeling. Updated data can also provide actual fish observations which are usually preferred over other 'Basis' designation types.

In 2022, we learned of the U.S Geological Survey (USGS) decision to discontinue its stewardship support for the National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD) in March 2023 and shift those resources towards the 3D Hydrography Program (3DHP). Since the adoption of the NHD and WBD as the State of Oregon's hydrography standard, ODFW and other state of Oregon agencies have collaboratively developed hydrography products which collectively support the missions of tribal, state, and local governments in Oregon. "Cessation of support for the NHD and WBD before the 3DHP model is finalized, available, and fully supported undermines the effectiveness of Oregon's hydrography standard." according to a letter from the Oregon Geographic Information Council (OGIC) to the USGS expressing concerns about the changes to the USGS hydrography program. Likely years of interrupted editing capability will cause a proliferation of divergent hydrography datasets. In its letter, OGIC requested, "…the USGS continue providing support for editing transactions on NHD and WBD until a new 3DHP system is fully developed and processes are in place for stewardship." Failure to do so, "…will have adverse effects on our ongoing work with these datasets and on mission-critical activities across the state…", including ODFW's efforts to provided updated FHD and barrier data to StreamNet.

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 2021 the GIS work continued to focused on fish distribution, population geometry reviews and supercode, linework and dataflow tools AND the addition of Hatchery location ID and verification for upcoming HCAX work. 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. Work this year also focused on effort to centralize the StreamNet data compiling via an online feature service.

E. CAP Fish HLIs

Work Elements:	159: DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX) 159: CAP Fish HLI (CAX) – DES, API, Database 160: StreamNet maintaining and enhancing data management 161: Improving data sharing with and access from StreamNet Data Systems

The CAP Coordinated Data Partnership aims to build automated HLI sharing capability in all the data source agencies. StreamNet works with the agencies to develop procedures for internal conversion of the data to regional standards defined in the Coordinated Assessments Data Exchange Standards, and continues to contribute to the coordination and standardization of monitoring data throughout the basin.

StreamNet staff and members actively supported improving data sharing capabilities in the region through the CAP, 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 CAP to the NOAA Salmon Population Summary (SPS) database, and continued to maintain this tool in 2022. In 2022, StreamNet staff also

continued to support NOAA staff accessing data directly from the CAX online query. Access to these data is also facilitated by the CAP Fish HLIs mapping query system, which displays HLIs in the CAX and related Fish Monitoring Data time series stored in the StreamNet database. The tabular version of the CAP Fish HLIs query that was initiated in 2021 to support filtering options and unique URL in response to user requests was completed in 2022.

This past year has been very active for the Coordinated Assessments Partnership (CAP) co-lead by PNAMP and StreamNet. With funding secured from an EPA Exchange Network grant, along with funding from BPA and NOAA IJFA, the CAP continued its work in the HCAX. During 2022, CAP made great strides towards regional sharing of hatchery fish high level indicators (HLIs) in 2022. A core group of the data stewards participating in the HCAX (i.e., HCAX Data Manager Work Group) developed data sharing rules and procedures using the HCAX Controlled Vocabulary completed at the end of 2021 by the HCAX Biologist Work Group In November 2022, we hosted the HCAX Project Workshop 2 to review and vet the draft DES. StreamNet staff used feedback from this workshop to improve the DES which will be used in 2023 to initiate pilot testing of the standard. This work was successful thanks to the 60 participants representing 24 organizations from around the region for providing input throughout the project. To learn more, access HCAX meeting documents on the Hatchery Data Sharing (HCAX) project page and see the draft DES on the StreamNet website here https://app.streamnet.org/ftpfiles/CoordinatedAssessments/DES/

The hatchery fish metrics and HLIs included in the pilot DES consist of four groups:

- Hatchery Program Information — such as program name, facility name, hatchery stock, species, run and agency contact.
- Hatchery Return Information — such as return year, return location, and marked and unmarked returns.
- Broodstock Spawning Information - such as number of natural and hatchery origin fish used as broodstock.
- Hatchery Release Information — such as year, location, date, and number released.
- Smolt to adult return rate Information — such as return and release location, outmigrant year, number released, and total returns.

The project is expected to be completed late in 2023. To learn more, access HCAX meeting documents at Hatchery Data Sharing (HCAX).

During CY 2022, the Shoshone-Bannock Tribes continued improving their data management and sharing capacity to flow data directly to the Coordinated Assessments Data Exchange (CAX) system instead of having IDFG submit on their behalf. The Nez Perce Tribe continued to successfully submit their data after their initial start in 2020, and the Yakama Nation's STAR data system continues to submit data. We continue to hear about improvements in the data sharing capacity of other CRITFC tribes, and we hope that this will translate to additional data being submitted to the CAX. Overall, during the calendar year 2022 the CAP partners continued to maintain and publish new records to the CAX resulting in a total of 15,004 records by the end of calendar year 2022 (Tables 9 and 10).

Table 9: Number of records of data, by high level indicator and StreamNet partner, as of 12/31/2021 and 12/31/2022.

High Level Indicator	Partner*	12/31/ 2021 records	12/31/ 2022 records
Natural Origin Spawner Abundance (NOSA) *Note that NOSA includes both escapement and true NOSA.*	Colville Tribes	19	106
	IDFG	1,417	1,436
	NPT	389	389
	ODFW	2,800	3,082
	USFWS	24	1
	WDFW	2,446	2,571
	YN	280	280
Presmolt Abundance	Colville Tribes	134	143
	ODFW	97	232
	PSMFC	1	1
	Terraqua Inc.	23	23
Juvenile Outmigrants	Biomark	31	31
	Colville Tribes	81	90
	IDFG**	785	620
	NPT	157	157
	ODFW	364	375
	SBT**	23	0
	WDFW	462	499
Smolt to Adult Return Rate (SAR)	Colville Tribes	18	20
	FPC	1,040	1,151
	ODFW	283	290
	USFWS	16	16
	WDFW	48	49
Recruits per Spawner (R/S) *(total value may include both adult and juvenile R/S)*	Colville Tribes	11	11
	IDFG	1,212	1,267
	ODFW	2,343	2,431
	USFWS**	13	10
	WDFW	313	324
Proportionate Natural Influence (PNI)	Colville Tribes	17	17
	WDFW	157	180
Total number of records	**All combined**	**15,004**	**15,802**

* 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; NPT = Nez Perce Tribe; ODFW = Oregon Department of Fish and Wildlife; PSMFC = Pacific States Marine Fisheries Commission; SBT = Shoshone-Bannock Tribes; USFWS = U.S. Fish and Wildlife Service; WDFW = Washington Department of Fish and Wildlife.

** The reduction of records shown in Table 9 that are associated with IDFG, SBT and USFWS in 2022 compared to 2021 are related to (1) USFWS removing NOSA and R/S records from eastern Washington following conversations between USFWS and WDFW about the methods used for those records and determining it was best to remove these USFWS records; (2) SBT and IDFG are in the process of reassigning records from IDFG to SBT for an agreed set of populations, resulting in changes in record counts as the transition is occurring. IDFG count will increase once IDFG completes its QA/QC for 2022 juvenile report, whereas others will be affected by the IDFG not operating some traps on South Fork Clearwater, Valley Creek, and East Fork Salmon River.

Table 10: Summary of populations represented in the data as of 12/31/ 2022, 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). The records included in the Priority group are also included in the Columbia River Basin group. Note that the Recruits per Spawner (R/S) total value may include both adult and juvenile R/S).

Population Group*	High Level Indicator	Pops	Superpops Only	Records	Year Range
Population of interest	Natural Origin Spawner Abundance (NOSA) *NOSA includes both escapement and true NOSA.*	67	1	2,851	1949 – 2022
	Presmolt Abundance	9	0	264	1993 – 2021
	Juvenile Outmigrants	45	0	1,132	1987 – 2022
	Smolt to Adult Return Rate (SAR)	59	41	380	1985 – 2019
	Recruits per Spawner (R/S)	52	12	2,233	1949 – 2018
	Proportionate Natural Influence (PNI)	4	0	164	1985 – 2021
Columbia River Basin	Natural Origin Spawner Abundance (NOSA)	182	1	6,956	1938 – 2022
	Presmolt Abundance	17	8	280	1993 – 2021
	Juvenile Outmigrants	72	4	1,608	1978 – 2022
	Smolt to Adult Return Rate (SAR)	100	75	1,402	1985 – 2019
	Recruits per Spawner (R/S)	87	14	3,307	1949 – 2018
	Proportionate Natural Influence (PNI)	5	0	197	1985 – 2021
Oregon Coast	Natural Origin Spawner Abundance (NOSA)**	21	9	909	1990 – 2021
	Presmolt Abundance**	0	5	119	1998 – 2021
	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	736	1994 – 2017
Puget Sound	Juvenile Outmigrants	2	0	32	1999 – 2019

*Population of interests = The 69 BPA Tier 1 and Tier 2 are priority populations identified during 2015 by BPA to support their reporting requirements under the Federal Columbia River Power System Biological Opinion.
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.
Puget Sound = Populations in Washington draining into Puget Sound / Strait of Juan de Fuca. These are outside the Columbia River Basin.

** For the Oregon Coast, values shown in Table 10, the unique number of independent populations (21) and superpopulations (9) are reported rather than the total number of populations (56) in the ESU. ODFW does not report dependent populations that are represented in a superpopulation, due to the small scale of the estimates. Rather, the independent (21) and dependent population (35) estimates are summed and reported together, representing a superpopulation (e.g., Oregon Coast Coho salmon ESU).

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.

The Colville Tribes' continued the process of automating HLI calculations, i.e., moving from spreadsheets to SQL views (scripts). In 2022, views were written to calculate NOS, pNOS, HOS, pHOS, NOB, pNOB, HOB, pHOB, PNI, and Recruits per Spawner. Testing of these views will be completed in early 2023.

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

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

4. Oregon Department of Fish and Wildlife

ODFW StreamNet acquired new and maintained existing data sets for population estimates from various contributors in the Columbia Basin. This resulted in the submission of populations of interest to BPA in the Lower Columbia, Middle Columbia, and Snake River that ODFW committed to in 2022 in Coordinated Assessments DES format.

ODFW staff calculated and submitted 2021 NOSA estimates for Lower Columbia fall Chinook that was missed the previous year due to field project staffing shortages and workload, new Presmolt Abundance indicator data for superpopulations of Lower Columbia (Oregon portion) and Oregon Coast coho salmon (using alternative funding source) by ESU and Stratum, and new NOSA and RperS data for three John Day River spring Chinook populations (North Fork, Middle Fork, and Upper John Day River).

Updates were also reinstated for populations where funding support was previously discontinued or altered. As a result, limited data for Hood River and Fifteenmile Creek winter steelhead were submitted with available HLI and metrics. Finally, updates and edits were conducted to follow validation rules of the DES and to standardize metadata, methods, and website URL's to be more consistent among similar records and populations.

In 2022, ODFW StreamNet staff completed enhancements and development of new tables in the internal web applications utilizing the ODFW Fish Monitoring & Data Distribution SQL server database that automates the processes for validation and submission to the StreamNet API. A production and test application for Population, SuperPopulation, Hatchery, TrendGroup, and TrendXTrendGroup tables was developed and is currently in operation. The new application

has increased efficiency, reduced potential errors, and eliminated previous DES data transfers to StreamNet. Data stewards with specific familiarity with a population and project enter data directly into the new system. In 2023, staff anticipate working on the HCAX tables and starting the remaining tables for PNI, Age and Hatchery Returns. Additionally, in 2022, ODFW StreamNet staff enhanced the Coordinated Assessment web application (CAVES) based upon feedback from user's experiences with the application. The whole system was brought into production in 2020.

5. Washington Department of Fish and Wildlife

WDFW recently implemented the new Salmon Population Indicator database, StreamNet staff spent some time testing the new database, suggesting improvements and changes, then using the data system to enter new data as well as update existing data. All WDFW StreamNet staff continue to load new or updated WDFW CA HLI NOSA data through the API.

WDFW is in the process of modifying their Salmon Population Indicator data base to carry CA indicator data and deliver them to the Coordinated Assessments Data Exchange (CAX) database using the StreamNet API.

WDFW StreamNet staff loaded the WDFW CAX database with NOSA (2020-2021) and SAR (2010+) data 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 CAX data in the upper Columbia Basin. These data were identified and were integrated into the CAX database.

The Lower Columbia Data Steward maintained existing data sets for population estimates, this consisted of submitting CA HLI data through the CAX database and API process. Currently working on compiling current and historical metric data to compliment the CA HLI data populations that already exist in the form of new Trends.

All StreamNet staff contributed and continue to contribute to the new design of the TWS (Traps, Weirs, Surveys) restructure (FTS - Fish Traps and Surveys) and to ensure all measurements were being collected to support metrics needed to create focal indicators.

6. CAP Co-Lead Update (PNAMP and StreamNet)

With an increasing number of new organizations submitting data to the Coordinated Assessments Data Exchange (CAX) system, most of whom were not engaged when CAP began in 2011, the need to tighten up CAP processes, improve documentation, and CAP communication became evident. One area of focus was improving how StreamNet and PNAMP can leverage their areas of expertise and membership to benefit CAP. In 2020 we formalized how the PNAMP Fish Monitoring Work Group (FMWG) can assist developing new HLIs identified by the StreamNet Executive Committee by bringing together the relevant fish and habitat experts, and how the FMWG can also assist the CAP DDT by participating in CAP DDT ad hoc workgroups as needed. The other area of focus was to address the need for better documentation and communication. In response to this need, the CAP co-leads Jen Bayer and Nancy Leonard, worked with the CAP Core Group that is facilitated by Jen (PNAMP) to update existing descriptive materials and to develop new materials where needed. These 2022 products include:

- Produced the fourth CAP newsletter in Summer 2022, with the fifth issue planned for Winter 2023 to cover latest update of HCAX and 2023 CAP Workshop (view all issues)
- Initiated several FMWG task group to receive input and, in some cases recommendations, for specific CAP/StreamNet data related topics
- Updated Five-Year Plan for Coordinated Assessments Partnership, adopted by the StreamNet Executive Committee in November 2022.

This effort to improve documentation and communication about CAP has also resulted in improved diagrams to describe relationships among groups (see StreamNet CAP webpages). These diagrams are also used in presentations such as presentations to CRITFC ITMD, StreamNet committees, and PNAMP Steering Committee (e.g., see Executive Committee

meeting documents) . This work also helped inform the StreamNet Vision and Strategic Plan adopted in September 2020 to ensure alignment in how overlap StreamNet-CAP groups and tasks are described (see StreamNet's CAP Process webpage and committees and teams webpages). Ongoing work includes implementation of issues discussed during the 2021 QA/QC interviews and plan development, and planning for the 2023 CAP workshop focused on biologists responsible for the data and the data managers. Other CAP related work is described in previous sections of this report.

Since 2011, PNAMP and the PSMFC StreamNet program have collaborated to manage the Coordinated Assessments Partnership (CAP). Over time, much has been refined and improved to continue to make progress towards the CAP's overarching goal of improving the timeliness, reliability, flow, and transparency of data necessary for regional assessments and management decisions for improved environmental effectiveness. PNAMP staff work with StreamNet and Bonneville Power Administration to support the CAP. PNAMP facilitates the Coordinated Assessments Core Team meetings and related workshops as requested. PNAMP also supports StreamNet staff's leadership of the DES Development Team (DDT), which maintains and provides updates to the DES. Participants in the CAP represent four states, six tribes, an inter-tribal consortium, and multiple federal regulatory agencies; all with an interest in collaboratively sharing fish population data for informing decision-making and reporting for fish populations in the Pacific Northwest. This work benefits from the existing facilitation framework provided by StreamNet, PNAMP, and the substantial cost share contributions from the Bonneville Power Administration. In addition, the project has benefited from multi-year grants from EPA to support HLI development and data sharing.

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

Work Elements:	159: DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX)

StreamNet maintains a thorough data validation system as detailed in the approach/methodology section. During CY2022, StreamNet PSMFC staff developed and gathered proposed changes to the DESs for both the CAP HLIs and for the fish monitoring data (StreamNet trends). These proposals were included in the draft/working copies of the DES versions. Because no new DES was adopted this year, neither were there related validation rule changes During CY2022 the CAP DES version adopted in July 2020 (Coordinated Assessments DES documents for current version (20200715) remained active. Validation rules were already in place for the 2020 DES version, and thus not updated in 2022. The 2020.1 version of StreamNet DES that guides the Fish Monitoring Data remain active during CY2022 as no version updates occurred in 2022. The charter adopted for each DDT (see team document table for CAP DDT Charter and SN DDT Charter) remains in effect and along with the updated 2021 version of the Data Exchange Standard Development and Revision Procedures.

The collaboration between StreamNet and PNAMP to leverage the PNAMP Fish Monitoring Work Group (FMWG) to generate recommendations to the StreamNet Executive Committee for improving data display continued to be very active in 2022 (see task group and products). We expect to continue leveraging this collaborative approach to inform tasks that benefit from broader input including DES, new data categories, and data display/queries.

1. The Confederated Tribes of the Colville Reservation

The Colville Tribes staff participated in the DES related meetings during 2022.

2. Idaho Department of Fish and Game

IDFG StreamNet staff continued to support the development and maintenance of Coordinated Assessments DES and CAX database, including HCAX. 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 databases. They also helped regional staff test updates to DES and validation.

3. Montana Fish, Wildlife & Parks

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

During 2022 MFWP staff participated in the development of the pilot Hatchery CAX (HCAX) Data Exchange Standard and will participate in testing the HCAX data flow in 2023.

4. Oregon Department of Fish and Wildlife

ODFW staff contributed input to CA DES (natural and hatchery origin) and Fish Monitoring Data (FMD) (trend data) discussions, various forums, and email correspondences throughout the year. Significant participation went towards discussions involving the Hatchery Coordinated Assessment Exchange (HCAX) ad hoc workgroup meetings facilitated by PNAMP and Regional StreamNet staff to draft a new HCAX data exchange standard (DES), including metrics, indicators, look-up lists, field names, and associated definitions. ODFW staff participated in the CAP process of developing a Quality Assurance Quality Control (QA/QC) Plan (adopted 2022), and the implementation of a pilot QC visual check on CA data. Staff continued involvement with workshops to improve general data display, super population display, juvenile data standard development, and connecting BPA projects and Monitoring Resources Study Plans (MonitoringResources.org) to metadata for FMD (trends).

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 2022. Began work on Hatchery HLI DES.

G. Metadata Documentation

Work Elements:	160: Infrastructure/equipment and base operations 160: Metadata Documentation

During 2022, metadata continued to be captured for data submitted to the StreamNet databases. The metadata captured differed depending on whether the data were submitted to the CAP Fish HLIs (CAX data system) or the Fish Monitoring Data (StreamNet trends data system), as described in Section IV.H. The Data Store online upload process requires that the organization uploading the data set provides descriptive information (metadata) 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 person providing the metadata and uploading the data set. Data Store metadata constitute an extension to the FGDC Biological Profile metadata standard.

The metadata requested by the StreamNet data systems is summarized below for each system:

- Fish Monitoring Data
  Due to the very large volume of individual records of fish monitoring data, each independent of all the others, metadata provided, by necessity, are limited.

  Each time series ("trend") has the following time series-level metadata:
  -- associated hatchery, if any;
  -- associated dam, if any;
  -- whether all known historical data are included;
  -- whether the time series is continuing to be added to the StreamNet database, and if not then why;
  -- organization that created the time series and is responsible for updates;
  -- comments associated with a time series;
  -- date and time the time series record was last updated.

  Each record of data for annual counts/estimates contains the following record-level metadata:
  -- general approach to field methods and calculation methods;
  -- comments associated with each individual annual record;
  -- organization that created the record and is responsible for updates;
  -- whether a regularly-scheduled annual measurement is unavailable, and why;
  -- a citation for a reference document where the data come from;
  -- date and time the record was last updated.

  In addition, when a fish monitoring data set is obtained from the StreamNet online query system it is given a time stamp to indicate the time at which the data set was created.

- CAP Fish HLIs
  Each record of data for fish HLI estimates contains the following record-level metadata:
  -- comments associated with each individual annual record;
  -- organization and contact person information for questions about the record;
  -- whether the value of that record is considered the providing organization's best available estimate (when multiple reasonable estimates are provided by that organization);
  -- protocols used to produce the HLI estimate (provided as name(s), URL(s), or document citation(s));
  -- whether the methods cited were adjusted when making this estimate;
  -- complete list of organizations that contributed to the estimate;
  -- whether a regularly-scheduled annual estimate in a time series is unavailable, and why;
  -- status of the data provided (draft, reviewed, or final);
  -- location where the source HLI is available;
  -- location(s) where "metrics" used to calculate the HLI are available;
  -- location(s) where field measurement data used to calculate the metrics are available;
  -- a citation for a reference document where the data come from;
  -- date and time the record was last updated.

  In addition, when a fish HLI data set is obtained from the CAX online query system it is given a time stamp to indicate the time at which the data set was created.

- Data Store
  The StreamNet Data Store uses and enforces the federal FGDC metadata standard, modified for Pacific Northwest fish data sets that are assumed to not have a GIS component.

- GIS Data

  All published GIS Data include FGDC compliant metadata with feature/record level metadata as provided by data compilers and set forth in the DES.

The documentation of metadata associated with data sets submitted to StreamNet could be further improved. During CY2022 StreamNet staff continued to work with PNAMP staff to explore how metadata documentation could be facilitated by connecting StreamNet data sets to the new MontoringResources.org (MR.org) Study Plan. Work funded by IJFA in 2021 to have a USGS biologist manually confirm existing steps and identify additional steps/modifications to support this StreamNet - MR.org connection. This work informed CY2022 discussions with the StreamNet data stewards to initiate the pilot connection, which was explored and resulted in better understanding options and associated level of effort to achieve this connection and is planned to be discussed with the StreamNet Steering Committee in 2023. In addition, the annual visual QC pilot was implemented during CY2022 with specific records assigned to each StreamNet funded partner to detect and document errors in a custom QC web-application. Discussions on the outcome of this QC pilot resulted in the StreamNet Steering Committee requesting refinements to the information captured by the QC web-application to further inform the value of this exercise when it is implemented in 2023 (see QA/QC plan for details on the pilot approach). Lastly, work continued in CY2022 to secure the supporting documents submitted along with data sets in the Library and to add a Library provided URL, and StreamNet staff provided the Library with all new Annual Project Reports from CBFISH.org to secure these in the Library using the automated process developed in 2021.

1. The Confederated Tribes of the Colville Reservation.

The metadata related to the compilation of field 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. Sampling and analysis protocols, and links to data sources were updated. Metadata are included in the GIS data, and in documents for non-GIS data.

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

ODFW StreamNet staff updated and standardized metadata within existing records in the Coordinated Assessments (CA) DES and updated or created metadata and data analysis flow diagrams for in-house datasets used to calculate and report high-level indicators. Additionally, ODFW StreamNet submits references associated with Fish Monitoring Data (FMD), Coordinated Assessments, and fish habitat distribution data to the Columbia Basin Fish and Wildlife Library and contributes references, data, GIS files, and metadata to the ODFW Data Clearinghouse.

In 2022, staff continued reviewing, editing, and validating FMD (trends) and CA records to identify potential improvements to protocol/method name and URL, method adjustments, trend status, historic status, and general comments associated with internal database records and information stored at StreamNet. Work will continue in 2023 in combination with the StreamNet Quality Assurance and Quality Control Plan (2022), CAP QAQC web application tool, and connecting BPA projects and Monitoring Resources Study Plans (MonitoringResources.org) to FMD metadata.

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 CAP 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: Transfer of data to secure and accessible repositories 160: Infrastructure/equipment and base operations

In 2022, server infrastructure was stable, backups maintained on all systems and data.

The StreamNet staff continued to maintain and implement the data backup approach described in Section IV-I above. No material changes in data backup systems were made in 2022. Annual testing of database restore function was initiated and tested. Previously, this was done intermittently.

I. Supported Reporting and Decision-Making Processes

Work Elements:	189: Coordination and Outreach 161: Reporting and Decision-Making Processes 119: StreamNet project administration 132: Produce annual progress report for CY2022

Regular meetings were held for ExCom and SN SC. 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. Subcontracts were executed and invoices tracked. New SOW and budgets were developed and provided to BPA. An inventory list and cost share report were developed and provided to BPA. All StreamNet funded partners engaged in meetings and related products, as well as contributed to the contractual reporting requirements, In summary,

- Colville Tribes
  - Participated in StreamNet Technical and Steering committee meetings as well as the DES Development Team. Budgets effectively tracked and managed.
  - Provided input that informed the quarterly status review, the Annual Report and Cost Share report.

- IDFG
  - IDFG StreamNet staff, budgets, and resources were effectively managed to meet all program objectives.
  - Provided input that informed the quarterly status review, the Annual Report and Cost Share report.

- MFWP
  - 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 the SOW and budget.
  - MFWP StreamNet staff provided input that informed the quarterly status review, the Annual Report and Cost Share report.
- ODFW
  - 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.
ODFW StreamNet staff summarized activities in preparation for completing the Annual Progress Report. Staff provided input for the Annual Report and participated in editing efforts. Staff also provided input that informed the quarterly status review and Cost Share report.

- WDFW
  - 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.
  - WDFW StreamNet staff provided input that informed the quarterly status review, the Annual Report and Cost Share report.

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 CAP Fish HLIs estimates through the CAX has facilitated BPA's pilot "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, CAP Fish HLI, and/or as a time-series (trends). To secure access to these supporting project documents that contain information on how data are collected and analyzed, StreamNet PSMFC staff provide the CBF&W Librarian with these documents and the library provided stable Library URLs for those documents submitted along with a data set. Library URLs for other documents associated with a data set are also being provided.

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 CAP and StreamNet committees and teams 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 CAP Fish HLIs map query (e.g., adult spawner abundance and productivity) to inform their status reviews and delisting decisions. The CAP's Fish HLI 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 this calendar year. The recent, and increasing use of StreamNet to access broader expertise via the PNAMP FMWG to address needed improvements to data accessed from StreamNet is also serving to inform changes to better support reporting and decision-making needs.

StreamNet Staff continued to provide support to NPCC staff and their Program Tracker contractors. NPCC staff continued throughout 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 D), and tracking progress towards Program goals, objectives and indicators (2014 FW Program Appendix C and its draft 2020 Addendum Part 1A). NPCC also has several online reporting tools that rely on StreamNet's Fish Monitoring Data query and the CAP Fish HLIs query including their mapping tools and Program Tracker. StreamNet maintains an API that allows NPCC to retrieve, in an automated way, data from the CAP Fish HLIs and specific sets of detailed Fish Monitoring Data "trend" for use in NPCC online reporting tools. During this calendar year, NPCC requested StreamNet assistance in displaying CAP Fish HLIs in groupings aligning with the MAFAC SPI for adult salmon and steelhead associated with the 2020 Addendum. Recommendations from FMWG Data Display Implementation Task Team informed a prototype of the CAP Fish HLI map query to display Columbia Basin Task Force Partnership goals for natural origin adult abundance and available estimates for populations within the CBTFP stocks (see the StreamNet Steering Committee and Executive Committee meeting notes and slides from September 2022). The CAP Fish map query prototype also demonstrated how content related to data status for

populations without CAP Fish HLIs estimates could be display based on recommendations from the FMWG Data Display Task Team. Input received from the September 2022 committee meetings are informing refinements to these prototypes and will be reviewed in 2023.

The 2022 Emerging Technology Information Session (ETIS) co-organized by StreamNet and the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) was held in Hood River from November 14-16, 2022. This three-day event on emerging technologies in aquatic monitoring and data management brought together monitoring professionals, project managers, field data collectors, data managers, and data consumers. The 2022 ETIS had more than 100 in-person and virtual attendees and included 52 presentations by presenters from the Pacific Northwest region as well as from Canada, Belgium, and Taiwan.

CAP also organized a special symposium at the annual meeting of the American Fisheries Society in August 2022 emphasizing successful data integration approaches to integrate fisheries and aquatic data across different boundaries and geographic scales. Titled **"***Bringing it all together: data integration for fisheries research and management success*", which created an opportunity to learn across projects and programs.

StreamNet staff are also serving on the PNAMP Fish Monitoring Work Group (FMWG) Core Team, assisting PNAMP in the organization and identification of topics for the FMWG. StreamNet staff engagement and assistance focuses on the tasks that aim to support the Coordinated Assessments Partnership and StreamNet by providing a venue for discussion of topics to inform tasks with appropriate subject matter experts (e.g. fisheries biologists, program managers, etc.). During this CY recommendations were provided to the StreamNet Executive Committee on improving the CAP Fish HLIs display, and other task groups co-lead by StreamNet PSMFC staff were initiated and are ongoing. See the PNAMP FMWG website for more details and access to task group documents.

1. The Confederated Tribes of the Colville Reservation
    - Data collected by the Colville Tribes and calculated HLIs are publicly accessible via both the okanoganmonitoring.org website and the "Colville Tribes Okanogan Monitoring and Evaluation Program Report Card" (https://ecosystems.azurewebsites.net/hstr-okanogan/).
    - Both websites are accessed to inform decisions related to habitat management projects and steelhead population restoration efforts.
2. Idaho Department of Fish and Game
    - IFWIS and StreamNet data compilation and access tools were used by IDFG and other organizations for research and management purposes.
    - Researchers and policy makers used the data to answer research questions in journal manuscripts, annual reports, fishery management plans, updates to status assessments, and ESA compliance.
3. Montana Department of Fish, Wildlife & Parks
    - MFWP data and information websites continue to provide access and the ability to share data for resident fish species important to the NPCC FW Program. These include:
    - The Fisheries Information 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 and data are continually updated.
    - 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 and link to Montana's fishing regulations.
4. Oregon Department of Fish and Wildlife
    - In 2017, the Oregon Legislature passed several mandates around state agencies' management, use and sharing of data. After the lead agency staffed up to administer the effort, they launched an Open Data

Portal (data.oregon.gov) and published an Open Data Standard, which requires agencies to maintain an inventory of agency information resources, identify publishable data and publish "publishable" data to the Open Data Portal. ODFW initiated an Open Data project to meet these requirements and began compiling a detailed Natural Resources Dataset Inventory (NRDI) in 2021 which continued into 2022. The NRDI will provide agency staff with increased visibility of datasets held by ODFW while also allowing the agency to respond more quickly and accurately to data requests, more easily locate data for decision making, understand needs for future data management systems, and move toward treating data consistently with other valuable agency assets and mature data governance structures in the agency.

- In 2022, ODFW continued work on the second stage of the Open Data Portal requirement by generating an Inventory of High-Use Information Assets that will allow the agency to better assess data applicability to, and prioritization for publication on the Oregon Open Data Portal. ODFW submitted its Open Data Plan and was approved to split the administrative and natural resource portions of the Data Inventory submission deliverable in order to further mature the natural resource portion. The State of Oregon Agency Data Inventory, including ODFW's administrative data inventory, can be found on the Open Data Portal at https://data.oregon.gov/Administrative/State-of-Oregon-Agency-Data-Inventory/yp9j-pm7w . Due to staff changes and a lack of other resources, ODFW ultimately paused its Open Data project in 2022, and continues to evaluate and pursue adequate resources to fulfill project requirements. NRIMP/StreamNet staff continue to identify datasets to add to the NRDI once staffing resources become available.
- ODFW also paused its Enterprise Governance Committee, first established in 2018, which was charged to determine the best data management and sharing approach for the agency, among other tasks. However, in 2022, the ODFW Take, Hold, Release, and Observe (THRO) Team continued their efforts and finalized a draft THRO Data Standard, crosswalk template, and authoritative agency species list for standardizing raw natural resources data within ODFW. This effort and these products are a crucial part of the future ODFW resource information system that will significantly advance the agency in areas of data management and increase data flow and sharing efficiency.
- In 2020, in response to legislation, ODFW initiated the creation of a Data Sharing and Non-Disclosure Agreement (DSNDA) template and online application for management and storage of agreements. Using other funding, Oregon StreamNet staff have co-led this effort since its inception. Use of the DSNDA template and online application started in 2021. Additional templates were developed for use with entities that could not legally abide by the terms of ODFW's standard template. ODFW is also crafting language that can be added to funding agreements that would meet the requirements of a DSNDA, thereby allowing the exchange of sensitive information without the need for a separate agreement. Once finalized, ODFW encourages BPA and Regional StreamNet to incorporate this language into future contracts with ODFW projects.
- Currently, ODFW maintains and provides access to salmon and steelhead information and data through several websites:
    - Data Clearinghouse (https://nrimp.dfw.state.or.us/DataClearinghouse/default.aspx?p=1) 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, https://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. 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 include:
        - SCoRe Interactive Map 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 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 (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 and Outreach 189: Supporting Data Requests

During CY2022 PSMFC StreamNet secured additional IJFA funding for FY22 (September 2021-August 2022). Part of this funding supported the Shoshone-Bannock Tribes as described in a previous section. Remaining funding went to support StreamNet and CAP activities by subcontracting for technical support and by providing USGS staff with support to assist with specific CAP related tasks. The StreamNet-PNAMP tasks focused on further enhancing the implementation of the CAP 5-year plan, along with current funding received from an EPA Exchange Network Grant and Bonneville Power Administration. StreamNet-PNAMP tasks initiated in CY2022 include:

- Support CAP task management, facilitation, and implementation in a manner consistent with the Five-Year Coordinated Assessments Partnership Work Plan.
- Schedule, lead, and attend regional coordination meetings regarding topics supporting CAP tasks and activities.
- Facilitate work sessions with data providers (biologists and data stewards) to improve data integrity (new fields and existing DES) and data fields.
- Further investigate options for improving the connection among CAP Fish HLIs, PNAMP MR.org, and CBFISH.

We continue to adhere to the 2021 updated DES change procedures, which included new DES implementation rules to lengthen to two months the time between DES adoption and implementation. We also adhered to our updated communication practices to data providers, to ensure all parties have a chance to respond to and implement these changes in their systems before they are adopted on the main database / API. The PSMFC StreamNet staff continue to provide YN staff with release notes when DES changes occur so that the automated exchange process can be updated and ensure the continued flow of data.

PSMFC StreamNet continued to

- engage in the CAP Core Team which serves to coordinate among StreamNet, CRITFC-ITMD, NOAA, BPA and states.
- organize and chair the StreamNet Steering Committee meetings and update the StreamNet Executive Committee.
- 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.
- convene and chair DES team meetings and SN Tech Team meetings to inform DES development/improvements.
- coordinate with PNAMP, including leveraging the PNAMP FMWG to convene a broader group of experts, including biologists, to inform tasks to enhance StreamNet products and data flow/access.

During 2022, the FMWG Task Group co-lead by PSMFC StreamNet staff worked with interested parties to develop recommendations for the StreamNet Executive Committee to improve data organization and display on the CAP Fish HLIs map query tool. Additional FMWG Task Groups are also in place to address other aspects beneficial to StreamNet, including, developing guidance for producing GIS polygons for focal fish species, and assessing options for modifying the StreamNet DES to accommodate time-series data sets collected by snorkeling surveys and electrofishing (See all tasks). 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, and our online services more robust. Seven non-trivial direct requests were received by PSMFC StreamNet staff in 2022. All were promptly and satisfactorily addressed.

1. The Confederated Tribes of the Colville Reservation

The Colville Tribes staff participated in the StreamNet Executive and Steering Committees, StreamNet Technical Team, and CAP/StreamNet DES Development Teams.

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 use for the Coordinated Assessments Partnership.

The Colville Tribes responded to approximately 24 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. Requests are for tables, graphs, charts, and GIS information.

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 data source workbooks and databases 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, SN, and CAX users increases, and people find data for themselves.

3. Montana Department of Fish, Wildlife & Parks

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 approximately 40 fisheries related map or data requests during the calendar year and all requests were fully satisfied.

4. Oregon Department of Fish and Wildlife

During 2022, ODFW staff participated in and contributed to the CAP DES Development Team (DDT), Hatchery Coordinated Assessments Exchange (HCAX) Development Team, PNAMP Fish Monitoring Work Group (FMWG), and the StreamNet Technical and Steering Committee meetings, along with state and other regional discussions, workshops and planning efforts related to trend data development and CAX data flow. Staff also participated in the ODFW East-West Fish Monitoring meeting to share methods and ideas on standardizing common monitoring efforts.

Oregon StreamNet staff responded to data requests coming from internal and external partners, with GIS, data and technical 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. The East Region StreamNet staff assisted District staff with knowledge and resources for local and historical data. Staff also responded to requests from StreamNet partners.

StreamNet Staff reviewed and provided significant feedback on the test displays for SuperPopulations and Populations on the CAP Fish HLI website. Detailed suggestions and improvements were submitted to Regional StreamNet staff for consideration. ODFW staff were also involved in workshops related to a juvenile density data standard development and connecting Fish Monitoring Data (FMD) (trends) to BPA projects and Monitoring Resources Study Plans (MonitoringResources.org).

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 2022, WDFW collaborated with CA partners to develop and submit a hatchery CAX grant proposal and preliminary scoping. WDFW StreamNet also participated in PNAMP Fish Monitoring Work Groups, to be informed of what the different work groups are working on as well as informing the work group with the correct people who have the knowledge and can contribute to what they are trying to accomplish. MG-2023

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 – Recommendations and Lessons Learned

StreamNet serves as a regional coordination body to support data management and facilitate cooperation across organizational boundaries. StreamNet supports coordination through establishing and implementing regional data exchange standards for a specific suite of fish monitoring data (time series trends) and fish HLIs, 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 the StreamNet data systems provide access to these data in a consistent format as agreed upon by the data providers.

The success of StreamNet relies on its staff, and partner and member organizations' ability to learn, adapt, and adjust to regional information needs. The dynamic arena of data management and technology provides challenges and opportunities that StreamNet must tackle to be responsive to data providers' and consumers' needs. These needs include improving processes and tools to both enhance access to quality data and strengthen proper use and attribution of data, while lessening the burden on data providers. Below we highlight some lessons learned and recommendations to further strengthen the StreamNet Program and its value to regional reporting and decision-making processes.

A. Recommendation for Supporting a Broader Group of Data Categories to Support Regional Information Needs

The diversity of data maintained by StreamNet addresses the different regional needs ranging from providing access to publicly funded data (such as via BPA ratepayers) to providing a common source of manager-approved data sets to inform regional decisions. In recent years these regional needs have become clearer and the approach used by StreamNet and CAP recognized as highly effective. The time is ripe for the Executive Committee to expand their guidance to StreamNet to improve data access for BPA, NOAA, NPCC and USFWS assessments and reporting needs, and to assist StreamNet, CAP, and its participants in securing funding to advance this work, whether through short-term grants or contracts or longer commitments (e.g. multi-year agreements or project funding). As this expansion occurs, it is however, important to keep in mind the limited resources available within partner agencies and tribes, and to ensure that adequate time and support is provided to complete new tasks prior to moving on to additional new tasks.

Recommendations to the Executive Committee members:

- Support expanding data flow for resident and anadromous fish from agency/tribal data systems to StreamNet data systems that contribute to informing the NPCC 2020 Addendum (goals, objectives, and indicators); and BPA and USFWS bull trout and sturgeon needs. For instance, some bull trout and resident fish time-series data are submitted to StreamNet's Fish Monitoring Data (trends) system; this could be expanded to be comprehensive and better support BPA, NPCC and USFWS.
- Support participation, either by providing in-kind or BPA funding, in PNAMP Fish Monitoring Work Group (FMWG)/StreamNet joint task groups to ensure proper representation by state and tribal natural resources experts to work on tasks that contribute to improving expanding data managed by StreamNet.
- Support implementation of the Five-Year Plan for Coordinated Assessments Partnership by strongly encouraging BPA, NPCC and USFWS to build on StreamNet/CAP successes for improving access to fish and related habitat data.
- Assist in securing short-term funding to support CAP co-leads to perform outreach with potential data providers outside of the Columbia River Basin to better support NOAA and USFWS. For example, WDFW began efforts in 2020 to facilitate submittal of NWIFC member tribes' data to the Fish HLI; however, the tribes wanted more information and discussions before supporting the flow of their data to CAP Fish HLIs (CAX system). StreamNet secured NOAA IJFA funding in September 2020 to support some initial outreach by StreamNet and PNAMP (CAP co-leads) with NWIFC in coordination with WDFW and NOAA. WDFW is continuing discussions with the NWIFC member tribes, however the CAP co-leads are restricted in their ability to assist by the one-year IJFA funding.
- Confirm with StreamNet partners the status of new tasks, to ensure these are completed before deciding to add on new tasks. Work with the StreamNet technical committees to ensure that tasks are being completed.

B. Recommendations to Secure Funding for Quality Data Exchange

BPA funding of the StreamNet project was adjusted to be $2,069,137 for FY2022 and not maintained at the October 2020 (FY 2021) reinstated amount of $2,145,483, which aligns with the budget recommended by the NPCC in 2019 (Figure 4 in Section III.D). The FY22 BPA funding allowed StreamNet to continue to fund StreamNet partners (Colville Tribes, IDFG, ODFW, MFWP, and WDFW) to the same level as during FY2021, and support the StreamNet PSMFC staff and fund some time to PSMFC GIS Center staff. The StreamNet Program Manager took on additional projects to cover the funding gap from FY21 and assigned some hours from two data specialists to assist with the 2022 ETIS, 2022 AFS symposium, and new CHaMP webpage. StreamNet PSMFC staff also secured additional funding from NOAA IJFA (September 2021-August 2022) and EPA Exchange Network Grant (December 2020 – September 2023) which, allowed StreamNet to continue make significant advances during FY2022. The combined funding from BPA, EPA, and HCAX has also allowed StreamNet to further support data management and sharing capacity of the Shoshone-Bannock Tribes; coordinate with PNAMP to support FMWG task teams that informed improvements to StreamNet data products; and given the small StreamNet PSMFC staff, allowed StreamNet to employ independent contractors to advance several priority tasks including the pilot ESRI dashboard to display data and information from multiple regional data systems related to rotary screw trap in one tool. During FY2022 StreamNet continued to show its ability to nimbly respond to priority tasks when additional funding is provided.

Recommendations to the Executive Committee members:

- Assist in **securing funding** to support StreamNet and CAP task maintenance, data quality, automation of the entire data flow process including calculations, and new tasks to better support the reporting needs of BPA, NOAA, NPCC and USFWS.
    - Facilitate discussions among BPA, NPCC, NOAA, and USFWS on funding avenues that could be secured to address new tasks, and to reduce the budget shortfall associated with decline in the purchasing power of the budget (i.e., the budget will effectively decline as costs increase).
    - Encourage BPA to consider providing and/or increasing funding for Columbia River Basin data stewards, especially with Tribal partners.
    - Encourage and support BPA and NPCC decisions to at a minimum reinstate the StreamNet base funding to $2,145,483, and provide critical cost-of-living adjustments to all StreamNet partners, to facilitate meeting the needs of BPA and NPCC (while keeping up with inflation). The $2,145,483 does not include ODFW portfolio funding.
    - Continue discussions with NOAA about contributing to StreamNet annual budget to maintain current support for their data needs and explore further enhancement to better address their information needs for the PNW.
    - Support efforts by StreamNet and PNAMP to secure alternative sources of funding to complement BPA funding such as EPA grants by providing letters of support and exploring synergies among federal agencies and multi-state compacts that consume StreamNet data.

C. Recommendation to Enhance and Maintain Access to High Quality Data

CAP Fish HLIs (CAX data system) has been flowing data since 2015. The increase in users accessing these data to inform their assessments and reporting, including BPA, NOAA, and NPCC, has raised awareness of needed improvements, including an on-going quality control procedure to ensure data integrity over-time.

During CY2022, StreamNet initiated a pilot visual QC process to assess the value of performing this work. This pilot is being repeated in CY2023 with modifications based on the CY2022 implementation. Depending on the effort needed some additional funding may be needed to support this new task. StreamNet also expects that some issues identified will require more in-depth work to properly address the problems, and may require working closely with biologists through the PNAMP FMWG, PNAMP MonitoringResources.org staff, and the CBF&W Library staff. This work will likely require additional funding, and StreamNet will be attempting to secure funding for this work once it is better defined.

Recommendations to the Executive Committee:

- Support implementation of the CAP Fish HLIs HLIs StreamNet Quality Assurance Quality Control Plan for StreamNet funded partners by providing BPA funding for this task.
- Support participation, either by providing in-kind or BPA funding, by all data providers and data consumers in discussions to refine or develop new data categories and exchange standards in PNAMP FMWG/StreamNet task groups to address issues that require input from a broader group of experts including biologists, fisheries managers, and CBF&W librarian.
- Advance implementation of improved metadata documentation within agencies' and tribes' data systems, especially for data of regional importance.
- Support continued engagement and collaboration with PNAMP MonitoringResources.org team to explore how the monitoring methods can further be improved to better support StreamNet and its partners' data documentation while considering the value added of options and the workload on project leads submitting content to MonitoringResources.org.
- Encourage partners to continue improving overall documentation of their field data collection and data analysis especially for data submitted to StreamNet.
- Provide timely updates for the following data categories that are to be submitted as spatial data (file geodatabase feature classes): fish distributions, trend features, and facilities. These spatial data should be submitted in a manner matching the existing GIS Data downloads files serve to limit the need for PSMFC to cross-walk the data file to be compatible and easily replaced or appended to the existing regional dataset.

D. Recommendation to 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 funded by the Program (e.g., hatchery, weirs, screens) and for fish distribution. Establishing StreamNet as the System of Record for these GIS data layers and associated attributes provides a definitive location for Columbia River basin information that is collaboratively informed by partners and facilitates consistency across users.

Recommendation:

- Encourage NPCC, in addition to BPA, to officially recognize PSMFC StreamNet GIS and the StreamNet database systems (Fish HLI and Fish Monitoring Data) as the System of Record for the Program. This would ensure that the underlying information informing BPA and NPCC assessments and reporting tools are based on the same information, thus reducing the potential for inconsistencies and confusion. This would also allow for a common set of information used among StreamNet, BPA, and NPCC GIS-based tools ensuring consistency in data display (e.g. hatchery facilities location and cross-walk of non-standardized names) across BPA, NPCC Program, as well as other partners.

E. Recommendation to Adequately Support State and Tribal Data Management Personnel and Participation in StreamNet

A critical component of StreamNet is being able to financially support data management staff within data-providing states and tribes. This tight connection between PSMFC-StreamNet and funded partners is instrumental in ensuring 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 Teams and Technical Team. The success of this approach is reflected in the increase in data submitted by The Colville Tribes since becoming a funded partner, and is also observed when StreamNet has the financial ability to fund small subcontracts with CRITFC ITMD project, CRITFC member tribes, and the SBT.

Recommendations:

- Encourage BPA and NPCC to consider providing and/or increasing funding for personnel supporting data management and exchange with StreamNet, especially with Tribal partners, including personnel fulfilling tasks related to data stewards, data coordinators, data analysts, data specialists, GIS technician, software developers, API software programmer/analyst, database administrators, data managers, and project analysts. This funding could be managed through the StreamNet project to facilitate coordination and engagement of all data providers submitting to the StreamNet data systems. This funding should complement, and not reduce, existing funding provided through individual projects and or through data management projects including the CRITFC ITMD (2008-507-00) project that partially supports data stewards, and the Intermountain Province / Pend Oreille Subbasin Data Management Project (2011-020-00).
- The Executive Committee should continue to encourage and invite other data providers, including CRITFC member tribes, NWIFC member tribes, SBT, NPT, and others to participate in and/or become members on both the Executive Committee and Steering Committee. Based on past discussions, funding may be required to secure the participation of tribes in StreamNet and CAP.
- Strengthen engagement and coordination among data stewards (e.g., database administrators, programmers, GIS experts) by leveraging existing teams.

F. Recommendation to Explore Opportunities and Assess Process to Connect Regional Systems

To facilitate understanding and access of data accessible from regional systems, we should continue to evaluate the potential to make systems with overlapping data consumers and data providers more similar, whether that be by using similar terms and definitions, or by providing similar interfaces and APIs. To add value to our existing data records we should also assess when it would be relevant to connect these to data in other systems.

- Encourage ongoing conversation with data providers to assess the feasibility of connecting records across systems and whether there are aspects of the data submittal process that can be improved/modified to facilitate submitting to these systems
- Encourage assessing and understanding which data systems are being accessed by the same data consumers and whether it would be beneficial to facilitate data use by aligning overlapping fields and terms (e.g. fish population names)

G. Recommendation Commit to Regular StreamNet and CAP Technical Team Meetings

To ensure ongoing awareness of technical improvements, increase efficiencies by identifying solutions to shared challenges, and timely updates to the data exchange standards, the technical team should meet on a regular basis, similar to the Steering Committee and Executive Committee.

- The technical team should meet virtually on a quarterly basis, or as needed); to discuss project related technological improvements, updates to data systems, challenges and shared solutions, and improvements to data exchange standards and processes. The technical team audience for each meeting is dependent on the agenda topic(s)
- During 2023 and onwards, the technical committee should focus on updates to existing data exchange standards (DES) for CA HLIs (natural origin fish) and Fish Monitoring Data (FMD) (trends). There is currently a backlog of pending updates and edits to approve, including 1) update validation rules, implement changes in databases, and publish updated DES's, and 2) review and develop DES tables, schema, and database for Hatchery Origin HLIs.

H. Lessons Learned about the Benefits of Streamlining Internal Data Submission for Direct Staff Data Submittal to CAP and StreamNet

Ensuring the **integrity and efficiency of data flow** requires ongoing maintenance and updates, including adopting advances in data management and reporting technology (open source and proprietary programs and tools) to improve efficiencies across the entire data life cycle. Several of the data providers are adopting a more automated data flow from field data collection to StreamNet's data systems. This is evolving the roles within an organization as to who ultimately submits the data to regional data systems, including delegating the decision to submit data into the CAX to the staff responsible for that data set. Approaches in place and under development differ in their specific approach, however, the development of similarly purposed applications for submitting fish data to Fish HLI (CAX) and to Fish Monitoring Data (SN Trends) would be beneficial to all StreamNet data providers. For example, ODFW's new Fish Monitoring and Data Distribution SQL server database and the web applications for Coordinated Assessments and Fish Monitoring Data (FMD) (trends) has enabled ODFW staff responsible for specific data to enter this data directly into the system for validation and submission to the StreamNet API. The new functionality has made ODFW's internal submission process more efficient and allows the responsible staff member to receive real-time data validation. Similar functionality could be beneficial to all StreamNet partners, and we plan to continue identifying improvements and adding new functionality in 2023.

The availability of a **fixed increase in financial support** for a certain number of years, such as the three-years of funding secured for HCAX, has shown to be integral in advancing standardization and sharing of specific priority data categories. For example, during 2021 ODFW StreamNet applied some of the HCAX funding from the EPA Exchange Network grant to hire a temporary staff member to inventory potential hatchery indicators, metrics, and hatchery program-related information to guide ODFW participation in the HCAX project. This allowed ODFW StreamNet to (1) lessen the workload on permanent staff; (2) describe the hatchery data types and formats collected by ODFW's Propagation Program such as location and attributes; (3) support timelier data compilation for testing of the hatchery data exchange web service in 2022 and subsequent final data submission; and (4) inform the Hatchery Biologist Work Groups development of data fields and controlled vocabulary by leveraging the inventory results. Furthermore, it is anticipated the HCAX inventory can be leveraged as a model for future projects, such as, a Coordinated Assessments DES for carrying capacity and white sturgeon. This approach should be endorsed and encourage for similar activities related to priorities discussed in the CAP Five-Year Plan for all StreamNet partner agencies and tribes (as time and resources allow).

I. Lessons Learned about the Importance of Communicating QA/QC and Improving Access to Data Consumers

StreamNet staff have been working on facilitating access to StreamNet data by different audience groups ranging in their technical expertise. To this end, StreamNet staff have developed a filterable API that better meets the custom data requests from the diversity of users accessing the StreamNet data system, and that is harvested to support StreamNet's query tools. Improving access of data maintained by StreamNet to audiences with different technical knowledge will increase the value and use of these data by the public and for informing decisions.

Furthermore, improving communication of the **quality of submitted data** provides data consumers with confidence in their use of these data, remains a priority and this will be further explored during 2023. The increased access to data has increased scrutiny and questions about quality control and assurance, as well as timeliness. This additional scrutiny has increased the overall quality of the data.

J. Lessons Learned on Efficient Approach to Access Needed Expertise

Leveraging **target work groups** with the required expertise (e.g., data stewards, biologist) to inform addition of data categories is efficient and effective, including coordinating with PNAMP staff for meeting facilitation expertise. The use of smaller workgroups via the StreamNet-PNAMP collaboration has illustrated the success of this approach as final products and recommendations have rapidly been achieved during 2022 to inform hatchery indicators and metrics, and improvements to data displays. Specifically, the purpose and scope of all StreamNet related meetings and involvement with the PNAMP Fish Monitoring Work Group (FMWG) in 2022 were focused, well organized, and well run. Each of the FMWGs utilized the expertise of biologists who are the subject matter experts in these areas to provide input that can then be further refined by data managers to develop a comprehensive DES for each subject. Another positive was, this approach-built energy and momentum to accomplish tasks and projects. This methodology streamlined efforts and allowed groups to stay focused on specific tasks. It is, however, recommended that the initiation of new tasks be balanced with the ongoing StreamNet tasks so that these new tasks and associated time commitment, including during and after meetings / work groups (assigned or voluntary), do not inadvertently distract from other StreamNet priorities. Thus, it should remain a focus that StreamNet partners complete ongoing work group meetings and tasks before engaging in other projects.

K. Lessons Learned about the Importance of Documentation for Data Integrity and Succession Planning

Proper documentation for data integrity is critical to ensure that these valuable data, funded by the public and rate-payers, remain accessible to inform critical uncertainties and decisions into the future. This applies both for data managed within an organization and for data submitted to regional data systems. Projects such as StreamNet serve a key role in ensuring that this documentation and the data needed to inform the assessment process are accessible and stable during any upcoming transition, such as retirement of core biologists with significant institutional knowledge about the data methods and analysis conducted. Some of the StreamNet partners have acknowledged that they also need better overall documentation of field collection and analysis to improve the quality of their data submissions to CAP Fish HLIs (CAX system) and are exploring how this can be accomplished, including utilizing PNAMP's MonitoringResources.org. StreamNet and PNAMP, with BPA support, continue to work on improving how to facilitate the connection between data submitted to StreamNet data systems and metadata submitted to MonitoringResources.org to reduce the burden on the data provider.

- Documentation is becoming even more crucial as staff with institutional knowledge are lost due to promotion, career changes, and retirements. For example, the Colville Tribes' OBMEP program has a small staff compared with the state agencies and a single person manages the data repository. Documentation is in place for certain OBMEP data processes (e.g., mark-recapture data processing, EDT calculations), but a more complete "handbook" is needed. ODFW is also preparing for the loss of personnel with institutional knowledge who have, and continue to keep the StreamNet Program functioning smoothly and applying lessons learned over time, by documenting new and existing processes as part of succession planning efforts, and to ensure coverage when needed.
- Documenting data set progress and procedures in accessible documents or project management applications like Asana.com is critical to maintain the integrity and stability of projects and workflows during periods of high personnel turnover.

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

Table 11a: 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	Engaged Sessions (new 2022)	Page Views	Ave. Page Views	Ave. Time on Site (min)	SNQ / CAX data (hits/usage)	Data API Usage (hits/usage)	Map applications Unique Visitors
2022	10,620	10,100	7,289	37,089	4	1	(rolled into main website 2022)	533,448	4,803
2021	6,658	6,533		13,794	2	1	3,621	475,897	5,470
2020	10,723	7,373		20,338	2	1	4,181	561,707	5,270
2019	11,774	8,232		23,458	2	1	6,968	425,710	5,794
2018	13,371	9,197		34,551	3	2		2,399,444*	5,659
2017	22,630	14,228		54,677	2	1		508,123	5,630
2016	29,708	18,399		83,182	3	3		412,504	5,252
2015	32,590	20,014		63,880	3	3		144,698	n/a
2014	39,171	31,424		75,112	2	1		51,358	n/a
2013	44,798	36,683		89,681	2	1		n/a	n/a
2012	27,163	19,291		66,686	2	1		n/a	n/a
2011	25,169	16,586		63,186	2	1		n/a	n/a
2010	23,029	13,924		49,725	2	2		n/a	n/a
2009	11,578	6,983		26,261	2	2		n/a	n/a

** New API feature allowing internal agency/tribal validation before data submission and new partners starting to use the API resulted in the large increase of usage in 2018 before stabilizing in 2019.*

Table 11b: Platform used to access the StreamNet website remains about the same between 2020 and 2021. Pre-2020 data are not available.

Year	Desktop	Mobile	Tablet
2022	73%	26%	1%
2021	77%	20%	3%
2020	84%	14%	2%

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: Status Summary of Work Elements

Details of the work conducted for each work element is described in the appropriate section of the report.

A summary of the work element milestones for the Contract 78040 Rel 14 is publicly available from www.CBFISH.org. The more detailed statement of work with descriptions and status is provided below.

Project: 1988-108-04 StreamNet
Contract: 78040 REL 41
Title: 1988-108-04 EXP STREAMNET
Contractor: Pacific States Marine Fisheries Commission
COTR: **Tom Pansky** & Brady Allen

C = Complete
G = will complete by the end date
Y = may not complete by the end date
R = will not complete by the end date
Gray-shaded milestones are Complete, Canceled, or outside the scope of the current reporting period.

A:119. StreamNet project administration

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. Submit physical inventory record	06/01/23	09/30/23		No				
B. Error-check & update actual WE budget spending w/in 4 months (reflect contract close-out value)	10/01/21	02/01/22		Yes		C		C
C. Begin drafting contract renewal documents and conduct internal review as needed	03/30/23	05/30/23		No				
D. Submit contract renewal package (SOW, Excel budget, property inventory) to BPA COTR	06/01/23	07/01/23		No				
E. Address comments and revise SOW, LIB, and PI as needed to get BPA manager approval	10/01/21	09/30/23		No	G	G	G	G
F. Return signed contract to BPA's Contracting Officer within 30 days	10/01/21	09/30/23		No	G	G	G	G
G. Submit final invoice for prior contract within 90 days to facilitate contract closeout	09/01/23	09/30/23		No				
H. Facilitate inputting Cost Share information into Pisces at the Project level	10/01/22	11/15/22		Yes				C
I. Comply with all applicable federal, state, tribal and local safety requirements, including reporting	10/01/21	09/30/23		No	G	G	G	G
J. Effective program management will be maintained by all StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW)	10/01/21	09/30/23		No	G	G	G	G
K. PSMFC Project oversight and guidance and project management of committees and teams	10/01/21	09/30/23		No	G	G	G	G
L. Facilitate inputting Cost Share information into Pisces at the Project level	10/01/21	11/15/21		Yes		C		C
M. Deliverable: Project is successfully administered		09/30/23		No	G	G	G	G

C = Complete
G = will complete by the end date
Y = may not complete by the end date
R = will not complete by the end date
Gray-shaded milestones are Complete, Canceled, or outside the scope of the current reporting period.

B:132. Produce annual progress report for CY2022

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. Non-Technical: Prepare for non-technical Progress Report. Review most recent guidance and template.	11/01/22	01/01/23		No				G
B. Non-Technical: Write Non-technical Progress Report	01/01/23	02/01/23		No				
C. Distribute Progress Report for Internal Contractor Review	02/01/23	03/15/23		No				
D. Distribute Progress Report for External Review to [Insert external review entity]	03/15/23	03/26/23		No				
E. Non-Technical: Upload Non-Technical Progress Report in Pisces	04/01/23	04/02/23		No				
F. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) will contribute to producing the Annual Report	01/01/23	03/26/23		No				
G. PSMFC Produce Annual Report	01/01/23	04/01/23		No				
H. Deliverable: Completed Annual Report		04/02/23		No	G	G	G	G

C:132. Produce annual progress report for CY2021

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. Non-Technical: Prepare for non-technical Progress Report. Review most recent guidance and template.	11/01/21	01/01/22		Yes		C		C
B. Non-Technical: Write Non-technical Progress Report	01/01/22	02/01/22		Yes		C		C
C. Distribute Progress Report for Internal Contractor Review	02/01/22	03/01/22		Yes		C		C
D. Distribute Progress Report for External Review to SN Steering Committee members	03/01/22	03/26/22		Yes		C		C
E. Non-Technical: Upload Non-Technical Progress Report in Pisces	04/02/22	04/04/22		Yes		C		C
F. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) will contribute to producing the Annual Report	01/01/22	03/26/22		Yes		C		C
G. PSMFC Produce Annual Report	01/01/22	04/01/22		Yes		C		C
H. Deliverable: Annual report submitted to BPA		04/04/22		03/31/2022		C		C

D:159. DES and Validation Process for Fish Monitoring Data (trends) and CAP Fish HLI (CAX)

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) engage in collaborative CAP/SN processes informing DES and data consumer understanding of these data	10/01/21	09/30/23		No	G	G	G	G
B. PSMFC- Support new and modifications of DESs, and data consumer understanding of these data	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: Update DES and Validation Rules		09/30/23		No	G	G	G	G

C = Complete
G = will complete by the end date
Y = may not complete by the end date
R = will not complete by the end date
Gray-shaded milestones are Complete, Canceled, or outside the scope of the current reporting period.

E:159. CAP Fish HLI (CAX) – DES, API, Database

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC StreamNet compile and deliver fish data to StreamNet databases.	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) will compile and deliver fish data to StreamNet databases.	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: CAP Fish HLI data sets informing regional BPA, BiOP, FW Program needs are updated and maintained		09/30/23		No	G	G	G	G

F:159. Fish Monitoring Data (Trends) – DES, API, Database

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC will ensure that data submittals to the Fish Monitoring Data (SN Trends) are efficiently performed	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) compile and submit data relevant to Fish Monitoring Data (SN Trends)	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: Fish Monitoring Data data sets informing regional BPA, BiOP, FW Program needs are updated and maintained		09/30/23		No	G	G	G	G

G:159. Transfer of data to secure and accessible repositories

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC StreamNet will continue to manage and improve the StreamNet Data Store as a repository for unstructured data & assist project sponsors transfer of data to secure and accessible repositories	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, and WDFW) will assist project sponsors with transfer of data to secure and accessible repositories	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: Support transfer of data into secure & accessible repositories		09/30/23		No	G	G	G	G

H:160. StreamNet maintaining and enhancing data management

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC maintaining and enhancing data management	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) will maintain and enhance their data management	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: Data flow is implemented efficiently		09/30/23		No	G	G	G	G

C = Complete
G = will complete by the end date
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Gray-shaded milestones are Complete, Canceled, or outside the scope of the current reporting period.

I:160. Implement and participate in processes described in the StreamNet QA/QC

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC support, implement and participate in processes described in the StreamNet QA/QC	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) implement and participate in processes described in the StreamNet QA/QC approach.	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: Improve data integrity		09/30/23		No	G	G	G	G

J:160. Infrastructure/equipment and base operations

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC infrastructure maintenance and base operations	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW): infrastructure maintenance and base operations	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: Project infrastructure and databases are maintained		09/30/23		No	G	G	G	G

K:160. Metadata Documentation

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC standardized data and metadata documentation	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) will provide metadata documentation	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: Appropriate metadata documented		09/30/23		No	G	G	G	G

L:161. Reporting and Decision-Making Processes

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC StreamNet improve and maintain access to information supporting BPA/NPCC FW Program, BiOp, regional reporting and decisions	10/01/21	09/30/23		No	G	G	G	G
B. Deliverable: Access to information s		09/30/23		No	G	G	G	G

M:161. GIS Data and Metadata

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC and all StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) will update GIS data sets and metadata supporting StreamNet needs	10/01/21	09/30/23		No	G	G	G	G
B. Deliverable: Updated GIS data		09/30/23		No	G	G	G	G

C = Complete
G = will complete by the end date
Y = may not complete by the end date
R = will not complete by the end date
Gray-shaded milestones are Complete, Canceled, or outside the scope of the current reporting period.

N:161. Improving data sharing with and access from, StreamNet Data Systems

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC disseminates the CAP Fish HLI and metrics, Fish Monitoring Data, and Data Store	10/01/21	09/30/23		No	G	G	G	G
B. PSMFC implements Data Sharing Agreements	10/01/21	09/30/23		No	G	G	G	G
C. PSMFC ensures maintenance of StreamNet Website, API, and Database Queries	10/01/21	09/30/23		No	G	G	G	G
D. PSMFC maintains access to non-copyright documents and facilitates locating copywrite documents supporting data housed at StreamNet	10/01/21	09/30/23		No	G	G	G	G
E. Deliverable: Data and metadata are accessible through StreamNet website, queries and API		09/30/23		No	G	G	G	G

P:189. Coordination and Outreach

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC coordination to improve data sharing both inside and outside the Fish and Wildlife Program & promote the project through technical and professional organizations	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) will engage in coordination to support data access and efficient exchange & promote the project	10/01/21	09/30/23		No	G	G	G	G
C. StreamNet supports implementation of BPA data management strategy and PNAMP MR.org	10/01/21	09/30/23		No	G	G	G	G
D. PSMFC- lead and engage in collaborative CAP/SN processes	10/01/21	09/30/23		No	G	G	G	G
E. Deliverable: Improved data sharing and engagement of data providers and consumers		09/30/23		No	G	G	G	G

Q:189. Supporting Data Requests

Milestone Title	Start	End	New End	Complete	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
A. PSMFC responds to and tracks data/information requests	10/01/21	09/30/23		No	G	G	G	G
B. All StreamNet funded partners (The Colville Tribes, IDFG, MFWP, ODFW, and WDFW) respond to and track data/information requests	10/01/21	09/30/23		No	G	G	G	G
C. Deliverable: Requests Addressed		09/30/23		No	G	G	G	G

X. Definitions of Terms and Acronyms

API	Application Programming Interface. A published standard format for communicating with applications.
BiOp	Federal Columbia River Power System Biological Opinion (FCRPS BiOp)
BPA	Bonneville Power Administration
CAP	Coordinated Assessments Partnership. A collaborative process to efficiently share and provide access to standardized derived information, such as fish population high level indicators (HLI) and supporting metrics. The geographic scope of the CAP is the Pacific Northwest with a focus on sharing natural and hatchery origin fish information and fish habitat-related information, such as fish population high level indicators (HLIs) and supporting metrics.
CAP DDT	Coordinated Assessments Partnership Data Exchange Standard Development Team. The CAP DDT consists mainly of the data contributing partners' data management professionals and biologists who calculate the HLIs and metrics. The CAP DDT is a team serving under the StreamNet Steering Committee that in turn serves under the StreamNet Executive Committee. The CAP DDT also coordinates, as needed, with the StreamNet Technical Team and the StreamNet DDT.
CBPTF	Columbia Basin Partnership Task Force
CAX	Coordinated Assessments Data Exchange. This is the aggregated database of Coordinated Assessments indicators and metrics submitted by data source agencies and housed at StreamNet.
CIS	Coordinated Information System
Colville Tribes	Confederated Tribes of the Colville Reservation
CHaMP	Columbia Habitat Monitoring Program
CRB or Basin	Columbia River Basin
CRITFC	Columbia River Intertribal Fish Commission
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CTWSRO	Confederated Tribes of the Warm Springs Reservation of Oregon
DES	Data Exchange Standard. The DESs is the set of formal rules for the structure of data elements for a data category, and documents agreements on the representation, format, definition, structuring, tagging, transmission, manipulation, use, and management of data in which data are shared. The document that holds the various DES for the different data categories in a database is referred to as the DES Document.
EN	Exchange Network: Nationwide data repository and exchange that resides within the EPA for EPA related data
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionary significant unit
FCRPS BiOp	Federal Columbia River Power System Biological Opinion
FERC	Federal Energy Regulatory Commission
FMD	Fish Monitoring Data (trends)

FMWG	Fish Monitoring Work Group
GIS	Geographic Information System
HAS	Hydro Assessment Study
HEP	Habitat Evaluation Procedures. HEP are used to evaluate and document habitat losses and habitat gains. HEP is 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.
HLI	high level indicator representing the estimated value for a group of fish, such as the natural origin spawner abundance estimate for a specific salmon population.
HSRG	Hatchery Scientific Review Group. HSRG is an independent scientific panel under the Pacific Northwest Hatchery Reform Project that reviewed hatcheries and developed comprehensive reform recommendations to improve the hatcheries role in meeting harvest and conservation goals for Pacific Northwest salmon and steelhead.
IDFG	Idaho Fish and Game's mission is to protect, preserve, perpetuate and manage Idaho's wildlife resources. A 1938 voter initiative created the Idaho Fish and Game Commission structure that governs the agency today.
ITMD	Inter-Tribal Monitoring Data. The purpose of CRITFC's ITMD project is to assist CRITFC and its member tribes in the timely and accurate capture, storage, processing, and dissemination of data for management of anadromous fish and their habitats. The CRITFC ITMD, by coordinating and integrating appropriate activities with the CAP, ensures consistent data sharing with the CAX data system for Basin salmon and steelhead high level indicators and related trend data.
MAFAC	Marine Fisheries Advisory Committee
MFWP	Montana Fish, Wildlife, and Parks. Fish and Wildlife Program's Mission: Steward the fish, wildlife, parks, and recreational resources for the public, now and into the future.
MR	Monitoring Resources
NED	Northwest Environmental Data Network
NOAA or NOAA-F	National Oceanic and Atmospheric Administration Fisheries, NOAA-F is responsible for the stewardship of the nation's ocean resources and their habitat. NOAA Fisheries provide vital services for the nation: productive and sustainable fisheries, safe sources of seafood, the recovery and conservation of protected resources, and healthy ecosystems—all backed by sound science and an ecosystem-based approach to management.
NOSA	Natural Origin Spawner Abundance. Number of natural origin fish that actually spawn, not necessarily the number of fish returning to a spawning area.
NPCC or Council	Northwest Power and Conservation Council. The 1980 Northwest Power Act authorized Idaho, Montana, Oregon, and Washington to develop a regional power plan and fish and wildlife program to balance the Northwest's environment and energy needs. The heart of the Council's mission is to preserve the benefits of the Columbia River for future generations.
NPT	Nez Perce Tribe
NWHS	Pacific Northwest Hydropower Database and Analysis System
NWIFC	Northwest Indian Fisheries Commission

OBMEP	Okanogan Basin Monitoring and Evaluation Program
ODFW	Oregon Department of Fish & Wildlife. ODFW mission's is to protect and enhance Oregon's fish and wildlife and their habitats for use and enjoyment by present and future generations.
OWEB	Oregon Watershed Enhancement Board
PNAMP	Pacific Northwest Aquatic Monitoring Partnership. PNAMP is a forum to facilitate collaboration around aquatic monitoring topics of interest, promote best practices for monitoring, and encourage coordination and integration of monitoring activities as appropriate.
PNI	Proportionate natural influence. PNI is an estimate of the relative selection pressure of the natural environment in an integrated natural / hatchery population.
PNW	Pacific Northwest
PNWRS	Pacific Northwest Rivers Study
PSMFC	Pacific States Marine Fisheries Commission. As stated by the governing compact, PSMFC's purpose shall be "to promote the better utilization of fisheries – marine, shell, and anadromous, which are of mutual concern, and to develop a joint program of protection and prevention of physical waste of such fisheries in all of those areas of the Pacific Ocean over which the compacting states jointly or separately now have or may hereafter acquire jurisdiction." Member states include California, Oregon, Washington, Idaho, and Alaska.
PTAGIS	Pit TAG Information System
QA	Quality Assurance, the process of ensuring that the development effort will result in the desired product. Quality assurance focuses on defect prevention. Typical quality assurance tools are check lists, project audits, and documented standards. QA activities typically occur up-front in a project.
QC	Quality Control, the process of verifying that product deliverables are complete, correct, and meet expected outcomes. Quality control focuses on defect identification. Typical quality control tools include products inspections and testing processes, and peer reviews. QC activities occur at the end of a project.
QA/QC	Quality Assurance/ Quality Control
RperS	Recruit per spawner ratios are specific to the locations and seasons described in each record of data. The number of "recruits" can be defined at any life stage.
REST	Representational State Transfer. For our purpose, this is a simple type of web service that is generally implemented via the common HTTP protocol (browser speak).
RMPC	Regional Mark Processing Center
RMIS	Regional Mark Information System
SARs	Smolt to adult returns. For natural origin fish this is the point estimate of the number of returning natural origin adults, divided by the point estimate of the number of smolts that produced those returning adults. This value is multiplied by 100 to obtain a percentage.
SBT	Shoshone-Bannock Tribes of Fort Hall
SOW	Statement of Work, from BPA contracts to describe Work Elements (WE)

SN ExCom	StreamNet Executive Committee provides policy-level guidance and decision-making for StreamNet and the CAP. The primary role of the SN ExCom is to ensure alignment with regional data management and sharing needs, that tasks are focused on achieving strategic goals, and that resources are allocated to regional and agency priorities.
SN SC	StreamNet Steering Committee. The Steering Committee provides support, guidance and oversight of progress for the StreamNet Program.
Status and Trends	"Status" describes the current condition of whatever is measured; "trends" described changes over time
StreamNet	Pacific States Marine Fisheries Commission's StreamNet Program that is a cooperative information management and data dissemination project focused on fisheries and aquatic data and data-related services in the Pacific Northwest, with a focus on the Columbia River Basin. , also name for a BPA funded project
Trend	Long-term temporal pattern (i.e. change over time) in what you are monitoring.
TRT	Technical Recovery Teams
USEPA	United States Environmental Protection Agency
USFWS	United States Fish & Wildlife Service. USFWS is the premier government agency dedicated to the conservation, protection, and enhancement of fish, wildlife and plants, and their habitats. USFWS is the only agency in the federal government whose primary responsibility is the conservation and management of these important natural resources for the American public.
USGS	United States Geological Survey
VSP	Viable Salmon Population
WA GSRO	Washington Governor’s Salmon Recovery Office
Wed Services	is platform-neutral, vendor-independent protocols that enable distributed processing to be performed using XML and Web-based technologies. Sometimes instantiated as remote procedures calls in which the request is an XML document. Or as more simply defined by StreamNet, an “always-on” function available at a specific World Wide Web address.
WDFW	Washington State Department of Fish & Wildlife. WDFW is dedicated to preserving, protecting, and perpetuating the state’s fish, wildlife, and ecosystems while providing sustainable fish and wildlife recreational and commercial opportunities.
YN	Confederated Tribes and Bands of the Yakama Nation

XI. References / Endnotes

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[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, revised September 2, 2020 https://www.streamnet.org/20200902-five-year-plan-for-coordinated-assessments-rev20200902-final-12/

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[vi] 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

[vii] 2014/2020 Columbia River Basin Fish and Wildlife Program https://www.nwcouncil.org/reports/2014-columbia-river-basin-fish-and-wildlife-program/

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

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

[xiii] Habitat Evaluation Procedures (HEP) https://www.streamnet.org/home/data-maps/hep/

[xivxiv] Hatchery Reform Project https://www.streamnet.org/home/data-maps/hatchery-reform/

[xv] 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

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[xvii] NPCC FW Program Protected Areas documentation, river reach, and online Protected Areas database and interactive map https://www.streamnet.org/home/data-maps/protectedareas/

[xviii] StreamNet subbasin plans and achieved datasets used during the NPCC2001-2004 subbasin planning effort https://www.streamnet.org/home/data-maps/subbasin-datasets/

[xix] StreamNet Fish Monitoring Data (replaces the previous StreamNet Query – Abundance Estimates and Indexes at Local Scales) https://www.streamnet.org/home/data-maps/fish-data/

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[xxi] StreamNet Fish HLI query https://cax.streamnet.org

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