International Fish Passage Conference Abstracts

Talks and poster presentations

University of California, Davis

May 4-8, 2026

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Primary Author: Luther Aadland

Affiliation: Aadland River Restoration

Title: Barrier Effects on Fish Communities Far From the Sea

Key Words: Barrier effects, species richness

Abstract:

At the center of North America, Minnesota has the headwaters of the Mississippi, St. Lawrence, and Red River of the North (Nelson) watersheds with 162 fish species (141 native) but only one diadromous species (American Eel). Using a comprehensive geo-referenced database, we assessed barrier effects on fish communities by comparing species richness in 32 sub-watersheds to that upstream of the first major barrier. Nineteen of these barriers were subsequently removed or modified with nature-like fishways. This allowed comparisons of upstream species richness associated with the fragmented river network to that of the free-flowing river. On average, watershed species richness upstream of barrier dams was 45% lower upstream of complete barriers, 27% lower above near-complete barriers and 17% lower above barriers that become inundated at bankfull flows. Pollution-sensitive, rare, long-migrants, and large-bodied species were most likely to be missing upstream of dams while pollution-tolerant species (including common carp) were least-vulnerable to fragmentation. Dam removal or installation of nature-like fishways resulted in an average return of 65% of species that had been missing upstream of the dams. Many species returned within a few months following barrier removal while a few were not detected for decades. In several cases, extirpated native mussel species recolonized following barrier removal and the return of their fish host species. We conclude that barrier construction is among the most definitive causes of fish biodiversity loss in freshwater ecosystems. Conversely, barrier removal is the most effective means of restoring them.

Primary Author: Derrick Alcott

Affiliation: California Department of Fish and Wildlife

Title: Juvenile Chinook salmon entrainment into flood bypasses via weir overtopping and other mechanisms

Key Words: salmon, floodplain, telemetry

Abstract:

The Flood Control Act of 1917 ushered in a wave of levee construction throughout the United States. Currently, remnant floodplain habitat in California's Sacramento River Valley exists primarily within flood bypasses (e.g., Sutter and Yolo Bypasses). Several weirs providing access to these bypasses are currently being modified to potentially improve fish passage. However, studies on baseline entrainment rates are lacking at many of the existing weirs. We used acoustic telemetry data of juvenile Chinook salmon (2015-2024) to investigate entrainment rates into Sutter Bypass as a function of spill rate at Tisdale Weir. We found that fish entrainment rates exceeded water spill proportions when less than 20% of river flow spilled over the weir. Above 20% spill, fish entrainment dropped below the proportion of water spilling. Modeled entrainment rates did not exceed ~40% under historically observed flow conditions. We also discovered that entrainment into the lower Sutter Bypass via backfilling, a largely unacknowledged entry mechanism, may be much more common than all weir entry points into Sutter Bypass. These data are important for resource managers to consider when analyzing the impacts of water infrastructure on fish, including listed Chinook salmon.

Primary Author: Greg Allen

Affiliation: Verdantas

Title: Restoring Fish Passage on the St. Croix River – Woodland Dam Fish Passage Project

Key Words: St. Croix, Woodland, Fish Passage, Fish LIft

Abstract:

The St. Croix River, also known as the Skutik, has the capacity to support one of the largest runs of migratory river herring in North America. For more than a century, fish passage at the Milltown, Woodland, and Grand Falls dams has limited access to more than six hundred miles of high quality habitat. A renewed cross border restoration effort is now transforming the system. Milltown Dam has been removed, a nature-like fishway is advancing at Grand Falls, and the Woodland Fish Passage Project is positioned to play a central role in restoring connectivity throughout the watershed. At Woodland Dam, Verdantas and its partners have designed new upstream and downstream passage facilities that address challenging site constraints and the very large alewife returns expected in the future. The upstream system includes a fish lift as well as a pool and chute ladder that together provide a robust and flexible passage solution. The downstream system includes improved bypass routing and screening to guide fish safely away from the turbines. The design process incorporated LiDAR surveys, three dimensional modeling, and extensive computational fluid dynamics analyses to refine hydraulic conditions at fishway entrances, conveyance channels, and bypass structures. These tools helped overcome limited space, the presence of critical mill infrastructure, and the unique fish attraction patterns observed at the site. The project reflects the efforts of many collaborators, including the Maine Department of Marine Resources, Woodland Pulp, the Passamaquoddy and Peskotomuhkati Tribes, NOAA Fisheries, the United States Fish and Wildlife Service, Fisheries and Oceans Canada, The Nature Conservancy, and regional research partners. Significant support from NOAA, the United States Fish and Wildlife Service, and the National Fish and Wildlife Foundation has allowed the project to advance toward construction. Together, these actions represent a major step toward restoring self sustaining runs of sea run fish to the St. Croix River.

Primary Author: Rory Alsberg

Affiliation: J.F. Brennan Company, Inc.

Title: Contractor's Perspective on Fish Passage Construction

Key Words: Construction, Marine Construction, Fish Passage, Early Contractor Involvement

Abstract:

This presentation provides a contractor’s perspective on fish passage implementation, drawing from J.F. Brennan Company’s experience as a marine contractor and builder of multiple fish passage projects, including the ongoing USACE Lock and Dam No. 22 Fish Passage Project. Working in and around water introduces challenges that are difficult to fully capture during design, including variable river conditions, access constraints, constructability of in-water features, and the selection of temporary versus permanent works such as cofferdams. This presentation will explore how these realities influence construction means and methods, schedule, and risk, and how early consideration of construction impacts can improve project outcomes. Key topics include executing work in active waterways, safely accessing upstream and downstream work areas, evaluating cofferdam strategies versus diver-supported construction, and applying specialized in-water construction capabilities. Lessons learned from completed projects will be shared through visual case studies, illustrating how construction decisions helped overcome site constraints and meet biological and hydraulic performance goals.The presentation will also discuss how a fish passage team’s understanding of fish passage objectives—such as species behavior, flow requirements, and operational constraints—can inform sequencing, temporary works, and quality control during construction. Finally, the benefits and limitations of early contractor engagement will be examined, along with practical recommendations for designers and agencies to improve constructability, reduce risk, and streamline delivery of fish passage projects. This construction-focused perspective is intended to complement the preceding planning, design, and performance discussions by grounding fish passage delivery in real-world field experience.

Primary Author: Nicholas Anderson

Affiliation: National Marine Fisheries Service

Title: Interagency Fish Passage and Protection Guidelines Biological and Ecological Overview

Key Words: Fish passage, ecology, guidelines, biology

Abstract:

The design of successful fish passage and protection measures requires understanding the biological and ecological requirements of a species or species assemblage. The U.S. Fish and Wildlife Service and National Marine Fisheries Service fish passage guidelines document will provide a broad ecological background on migratory species which previously has been the primary focus of biological guidelines or mostly absent from fish passage engineering design criteria. We provide a summary of this section and the species-specific biological plates included in the document to share key biological and ecological considerations when designing fish passage such as life history characteristics, species-specific behaviors, locomotion and sensory strategies, bioenergetics, and population and community dynamics. The intent of the fish ecology section is to provide an overview of the best available scientific information and encourage design teams to seek out and incorporate species- and watershed-species information for the design of migratory fish passage.

Primary Author: Shahid Anwar

Affiliation: California Department of Water Resources

Title: Effectiveness of the Bio-Acoustic Fish Fence at Sacramento River and Georgiana Slough Junction in Reducing Juvenile Salmon Entrainment

Key Words: bioacoustics fish fence, Georgiana slough

Abstract:

The migration of juvenile Chinook Salmon into interior channels of the Sacramento–San Joaquin Delta significantly lowers their chances of survival due to heightened risks from predators and water diversion infrastructure. One critical pathway, Georgiana Slough, draws fish away from the mainstem Sacramento River into areas with lower survival probabilities. To mitigate this, the Department of Water Resources operates the Georgiana Slough Salmonid Migratory Barrier (GSSMB), a seasonal deterrent system designed to guide juvenile salmon along safer migratory routes. The GSSMB employs a Bio-Acoustic Fish Fence (BAFF) composed of acoustic signals, strobe lighting, and a curtain of bubbles to influence fish behavior. The bubble curtain forms a vertically oriented zone of turbulence and acoustic disturbance that disrupts flow cues commonly used by fish for navigation. Underwater sound projectors emit frequencies to which juvenile salmonids are particularly sensitive, reinforcing avoidance behavior, while strobe lights provide an additional visual stimulus under suitable light conditions. The system operates seasonally from November through June under State Water Project regulatory requirements. This study assesses the BAFF's performance using multi-season velocity data collected via Acoustic Doppler Current Profilers (ADCPs), which capture flow dynamics such as speed, direction, shear, and secondary circulation during varying river discharge and tidal phases. Analysis indicates that the effectiveness of fish deterrence is closely tied to how well the BAFF aligns with prevailing flow structures, particularly streaklines and lateral velocity gradients. When river flows moderate to high, the system successfully redirects fish away from the slough, even under turbid water conditions. However, during low-flow or tidal reversal events, complex flow patterns reduce its guidance capability. As an example of a long-term, large-scale behavioral deterrent integrated with hydraulic analysis, the GSSMB contributes critical insights into future fish passage improvements and ecosystem management within the Delta.

Primary Author: Muhammad Usama Ashraf

Affiliation: Great Lakes Fishery Commission

Title: From Evidence to Design: Modeling of Multi-Step Sorting Systems for Selective Fish Passage

Key Words: river fragmentation, fish passage, selective connectivity, fish sorting technologies

Abstract:

River fragmentation threatens migratory fishes worldwide. Fish passage structures and barrier removal can mitigate impacts of river fragmentation on migratory species but may also create dispersal corridors for invasive species, creating a management dilemma known as the connectivity conundrum. Selective connectivity aims to resolve this dilemma by passing desirable species while blocking or removing undesirable ones, using sorting technologies that exploit interspecific differences in fish behavior, morphology, physiology, and phenology. Using an expert-informed literature review, we compiled guidance efficacy data across 18 sorting technologies from >340 studies for 30 migratory fish species most common to the lower Boardman/Ottaway River (Michigan, USA). These species represent a variety of sizes and life histories, including numerous types of potamodromous migratory species common to the Great Lakes. Data coverage remains skewed toward sea lamprey, salmonids, and invasive carps, with substantial data gaps and an overall coverage across species and technologies of 59%. To translate this evidence base into actionable system design for FishPass (a project that replaces the last and lowermost dam on the river with infrastructure designed to facilitate testing and development of selective fish passage solutions), we couple the empirical database with a Bayesian sorting analysis. This analysis treats selective fish passage as a probabilistic, multi-step separation problem with each sorting step having a binary outcome, such as guided and unguided fish. For each candidate technology, species-specific performance is represented as numerical efficacy informed by the literature. We analyze all valid combinations of these steps arranged as flow networks and evaluate system-level passage and rejection for desirable and undesirable species. Together, the synthesis and Bayesian sorting analysis provide an empirical and quantitative basis for designing, testing, and adaptively operating selective fish passage systems at FishPass and for informing multispecies passage planning across the Laurentian Great Lakes and beyond.

Primary Author: Markus Aufleger

Affiliation: University of Innsbruck, Hydraulic Engineering

Title: Hybrid Fish Protection Using the FishProtector Technology – Concept, Functionality, and Practical Applications

Key Words: Hybrid fish protection, electrified bar screens

Abstract:

Effective fish protection at water intakes of hydropower and other water infrastructure remains a major ecological and technical challenge. Conventional solutions, such as fine screens or purely behavioral deterrents, often face limitations related to hydraulic performance, operational reliability, retrofit feasibility, or inconsistent biological effectiveness. Hybrid fish protection systems therefore offer a promising alternative. The FishProtector technology is a modular hybrid concept that combines mechanical barriers with localized, pulsed electric fields. Depending on site-specific requirements, the mechanical component may consist of bar screens, fixed cable structures, or flexible cable systems. Electrodes are directly integrated into these structures and connected to an external pulse generator, creating a weak electric field confined to the immediate vicinity of the barrier. The functional principle exploits natural fish behavior. Approaching fish first perceive the mechanical structure and orient rheotactically against the flow. Upon closer approach, the caudal fin enters the electric field, triggering a controlled avoidance response directed upstream or along the structure. This interaction results in an effective behavioral barrier while avoiding large-scale electric fields and associated risks such as galvanotaxis or narcosis.A key advantage of the FishProtector technology is that it enables effective fish protection with comparatively large structural spacings, thereby reducing head losses, simplifying debris management, and improving operational robustness. The systems can be applied both in new installations and as retrofits at existing intake structures without compromising hydraulic or structural functions. The technology has reached a high level of technical maturity and has been validated in laboratory, pilot-scale, and field applications. Ongoing research focuses on optimizing electrode configurations and pulse characteristics to ensure robust performance across species, hydraulic conditions, and operational regimes.

Primary Author: Vincent Autier

Affiliation: BC Hydro

Title: Lessons learned from a staged approach to upstream fish passage at Site C, new hydroelectric dam British Columbia, Canada

Key Words: fish passage, fishway design, telemetry, fish migration

Abstract:

BC Hydro has completed construction of the Site C Clean Energy Project, which is the third hydroelectric dam on the Peace River in northeastern British Columbia, Canada. We implemented a staged approach to upstream fish passage at Site C, whereby a temporary upstream fish passage facility was operated during the river diversion phase of construction (2020 to 2024). Following the closure of the diversion tunnels and reservoir filling in the fall of 2024, we began operating the permanent upstream fish passage facility at the outlet of the generating station to provide for fish passage during the operations phase of Site C. Here we share key lessons learned from 15 years of planning, design, construction, and operation of the temporary and permanent facilities, which represented a unique effort involving a new large hydroelectric development and construction sequencing approach. Importantly, the surprises and mistakes we encountered – no matter the scale or implication – reinforced the unique opportunity to learn from the temporary facility and apply those learnings to the design, construction, and operation of the permanent facility. Our lessons learned span a wide range of topics and disciplines – collaborating with experts, engaging external parties, locating the fishway entrance, designing for operational flexibility, effectiveness monitoring and operator safety, team structure, construction tolerances, construction team experience , and the behavioural response of fish – and should prove useful to practitioners, natural resource managers, biologists, and engineers involved in new or existing fish passage projects elsewhere.

Primary Author: Ryan Baird

Affiliation: Kleinschmidt Associates

Title: Preparing for Fish Passage Projects - Site Considerations and Data Gathering

Key Words: Fish Passage, Data, Planning

Abstract:

Fish passage is a critical yet complex component of water infrastructure projects, requiring solutions that are biologically effective and site-specific. This presentation highlights that fish passage performance and project cost are heavily influenced by early project scoping and the quality of site data collected during the early planning stage. Decisions made (or not made) during the early planning stage often set long-term constraints on feasibility, constructability, and operational success. Key hydraulic considerations include river flows, sediment dynamics, headpond and tailwater levels, operational constraints, attraction flows, and fishway internal depths and velocities. These factors interact with biological requirements in ways that can amplify uncertainty if not adequately characterized early. Site-specific elements such as surveys, bathymetry, subsurface geotechnical conditions, debris and ice conditions, access limitations, property ownership, and regulatory requirements further influence design outcomes and implementation strategies. Fish passage design is inherently iterative, often requiring study, testing, and refinement as new information emerges. This presentation draws on project experience to illustrate how incomplete, or late-stage data collection can lead to redesign, cost escalation, and schedule impacts, while targeted early investigations can improve confidence and expand viable design alternatives. The presentation emphasizes the importance of early planning, engagement with regulators and stakeholders, and investment in high-quality data collection. Proactive data management and early expert involvement are shown to reduce risk, improve interdisciplinary coordination, and support effective, resilient, and innovative fish passage solutions.

Primary Author: Sarah Baird

Affiliation: University of California, Davis

Title: Swimming performance of subadult and adult green and white sturgeon with varying substrate type

Key Words: swimming performance, adult sturgeon, passage criteria

Abstract:

Across the northern hemisphere, subadult and adult sturgeon encounter fish passage facilities and water diversion structures along migratory routes. These facilities often produce unnatural hydraulic conditions, which may impede fish passage. To adequately design and operate passage facilities, the swimming capacity of all fish of concern must be considered. Due to their large body size and long life-span, assessing the swimming performance of subadult and adult sturgeon species is rarely accomplished, yet this knowledge is critical for establishing effective passage. In a large indoor flume, the maximum sustained swimming speeds (Ucrit) of subadult and adult green sturgeon (Acipenser medirostris) and white sturgeon (A. transmontanus) were tested. All life stages were evaluated in smooth-bottomed conditions, and subadults were further evaluated with the addition of gravel- and cobble-sized substrate. For smooth-bottomed trials, white sturgeon of both age classes had significantly higher absolute (feet per second, ft/s) and relative (body lengths per second, bl/s) Ucrit values than green sturgeon. Within species, relative Ucrit values decreased with fish size, yet there was no significant difference between subadult and adult fish in absolute Ucrit values. Gravel addition resulted in the highest absolute Ucrit values for both species, while cobble produced lowest absolute Ucrit values. For green sturgeon, the addition of either substrate reduced relative Ucrit values, with lowest associated with cobble. These data suggest that substrate size influences the swimming ability of subadult and adult sturgeon, and should be considered when designing fish passage structures. Additionally, there may be important species-specific differences in the relationship between substrate size and swimming ability, possibly due to differences in benthic behaviors and patterns of station holding.

Primary Author: Casey Baldwin

Affiliation: Confederated Tribes of the Colville Reservation

Title: Behavior, spawning, juvenile production and uncertainties for adult salmon released into the blocked area of the Upper Columbia River.

Key Words: Grand Coulee Dam, Columbia River, Trap & Transport, P2IP, Salmon Reintroduction

Abstract:

Salmon were eliminated from the waters upstream of Chief Joseph, Grand Coulee and 3 dams on the Spokane River for 80-110 years before the UCUT tribes began their reintroduction program almost 10 years ago. A tribally led, modest and hopeful start has grown into a federally supported and funded program that is evolving every year. Adult salmon trap and transport upstream of Chief Joseph Dam (CJD) and Grand Coulee Dam (GCD) has played a vital role in salmon reintroduction to the upper Columbia since its inception. The UCUT tribes immediately saw the benefits of bringing adult salmon back into the blocked habitat. There were social benefits, funding benefits and even cultural/spiritual benefits that are difficult to quantify, but impossible to deny. However, this presentation will focus on the biological benefits and observations from the first several years of the trap and transport of adult Chinook. Acoustic tracking studies have been conducted to document fish survival, movement and behavior for adult Chinook salmon. In general, the studies have shown low mortality, low fallback through the dams and extensive movements throughout reservoir habitats. Spawning ground monitoring has demonstrated that the fish, though naïve to the area, were able to find and utilize suitable spawning habitat. Challenges remain in documenting spawning in large mainstem habitats that exist in several key potential production areas. Additionally, the production of natural-born juvenile offspring has been documented in two key tributaries which will also aid in supplying test subjects for future outmigration studies. Although many questions remain unanswered, it is clear that beginning the program by getting adult salmon back into the habitat was a critical and highly successful strategy in the program.

Primary Author: Lars Berglund

Affiliation: WEST Consultants, Inc.

Title: Success Within Constraints: Semi-Urban Stream Restoration at SR202

Key Words: Restoration, Barrier Correction, Highway

Abstract:

Washington State Department of Transportation's fish passage program is one of the largest ecological restoration efforts in the Pacific Northwest. While the 2013 injunction mandates barrier removal, many sites create opportunities for broader habitat and floodplain restoration. The recently constructed SR 202 barrier removal project for High School Creek in King County, Washington, illustrates how fish passage barrier corrections can serve as a foundation for multi-benefit restoration.The site is located at the interface of suburban neighborhoods and the agricultural Sammamish River floodplain. Urbanization in the headwaters has increased hydrologic flashiness, creating confined, incised alignments disconnected from their floodplain. The project replaced two existing barrier culverts with a single 25-ft bridge, and built 1,447 feet of new channel. The constructed alignment routes flow away from roadways, improving both habitat function and water quality.Downstream infrastructure constraints limited the ability to raise the channel to natural grade, risking a design that could replicate the existing incised, high-velocity conditions. To address this, the design incorporates three broad floodplain benches that dissipate energy and provide high-flow off-channel refugia to juvenile salmon. These benches were crucial in re-establishing floodplain connectivity and enabling long-term channel evolution. Restoration features included 337 pieces of large woody material, as well as extensive riparian plantings designed for zones of prolonged inundation. Innovative anchoring techniques were required to stabilize large wood in a backwatered environment.The project highlights how fish passage barrier corrections can be leveraged to achieve reach- or segment-scale benefits by integrating habitat, stormwater, and infrastructure goals. It also underscores the importance of collaboration between state, tribal, and local organizations throughout the design process. This presentation will review site-specific design challenges, share lessons learned from the first year of project evolution, and highlight transferable strategies for future restoration projects in similarly urbanized or constrained settings.

Primary Author: Shaun Bevan

Affiliation: HDR Engineering, Inc.

Title: Salmonid Stream Crossing Design Frameworks in Washington State: Policy to Practice

Key Words: WSDOT, WDFW, water crossings

Abstract:

Restoring aquatic connectivity is a critical priority throughout the Pacific Northwest, where road–stream crossings have fragmented habitat, reduced ecological resilience, and constrained recovery of threatened and endangered salmonid populations. Fish passage design practice in Washington State has historically been anchored in the 2013 Washington Department of Fish and Wildlife (WDFW) Water Crossing Design Guidelines, which formalized geomorphically based, stream-simulation approaches for fish-passable crossings. More recently, these state-level standards have been complemented and, in some cases, advanced through agency-specific guidance and updated regional recommendations. This presentation provides a comparative overview of three primary technical frameworks currently shaping salmonid stream crossing design in Washington, Oregon, and Idaho: (1) the WDFW 2013 Water Crossing Design Guidelines; (2) the Washington State Department of Transportation (WSDOT) Hydraulics Manual; and (3) the NOAA Fisheries 2023 Guidelines for Salmonid Stream Crossings in Washington, Oregon, and Idaho. Together, these documents define evolving expectations for hydraulic performance, geomorphic context, ecological function, and long-term resilience of water crossing structures. In addition to comparing these guidance frameworks, the presentation highlights recent research and lessons learned from WSDOT's approximately $8-billion Fish Passage Program, with particular emphasis on advancing channel complexity and geomorphic function within water crossings through large-scale implementation and monitoring. By synthesizing policy, engineering guidance, and applied lessons learned across jurisdictions, this presentation offers broadly transferable insights for practitioners designing resilient, fish-passable crossings in diverse geomorphic and regulatory settings.

Primary Author: Thomas Biladeau

Affiliation: Coeur d'Alene Tribe

Title: Evaluating outmigration behavior and survival of juvenile Chinook and Sockeye salmon in the blocked area of the Upper Columbia River

Key Words: Reintroduction, Fish Passage, Acoustic Telemetry, Columbia River

Abstract:

The Upper Columbia United Tribes (UCUT) are leading an effort to reintroduce anadromous salmon in the blocked areas of the Upper Columbia River. Throughout the first step of this effort, UCUT, in collaboration with the United States Geological Survey (USGS) and Pacific Northwest National Labs (PNNL), are gathering baseline information on migration survival and behavior of juvenile summer Chinook and Sockeye salmon. The studies have provided information on migration timing, reach survival, and an evaluation of passage survival and behavior at multiple dams throughout the study area. The information from these studies is critical for informing fish passage and other long-term reintroduction strategies.

Primary Author: Josh Black

Affiliation: California Department of Water Resources

Title: California Department of Water Resources Riverine Stewardship Program: Facilitating Native Fish Habitat Restoration and Passage Improvements in California

Key Words: fish passage, restoration, riverine

Abstract:

The California Department of Water Resources' Riverine Stewardship Program (RSP) uses public funds awarded to grantees to plan and implement projects benefitting native fish riparian habitat restoration, fish passage, public environmental education, climate change adaptation to warmer water temperatures and more frequent flooding events, and infrastructure improvements providing multiple benefits for aquatic species and people. RSP coordinates with local public agencies, state and federal agencies, and non-governmental organizations to assist grantees with planning and implementation of projects. Examples of the type of projects that the RSP funds and has funded include low water crossing conversion to large box culvert bridges to improve fish passage and migration corridors, off-channel floodplain creation and improvements, spawning gravel injection for salmonids, reconnection of remnant channels to mainstem tributaries, restoration of riparian areas with native plants, removal of agricultural weirs blocking fish passage improving water quality and flow, and screening agricultural intakes to prevent fish entrainment. The RSP continues to explore future opportunities for facilitating and progressing restoration of California's riverine and riparian ecosystems.

Primary Author: Aaron Blake

Affiliation: Environmental Science Associates

Title: A machine learning optimization tool for designing fish guidance structures

Key Words: fish guidance machine learning

Abstract:

Survival of juvenile Chinook salmon out-migrating from the Sacramento River through the Sacramento–San Joaquin River Delta remains low and is strongly influenced by routing probabilities within the North Delta. Behavioral guidance structures offer a means to influence these routing probabilities, but their effectiveness depends on the interplay between guidance structure placement and design and the range of tidal and hydrologic conditions when juvenile salmon are present. Both the probability that juvenile salmon will be present in a particular junction, and the relative survival between junction routes, vary seasonally with the Sacramento River hydrograph. Managers seeking to optimize behavioral guidance structures in the North Delta must consider these complex biological, physical, and environmental interactions. To address this need, we developed a machine learning Barrier Optimization Tool (BOT) to jointly optimize the design of fish guidance structures in the Sutter Slough, Steamboat Slough, and Georgiana Slough junctions. This BOT consisted of: an individual based model (IBM) to simulate the two-dimensional movement of juvenile salmon in these junctions; an individual based implementation of the STARS statistical model; a distributed modeling framework to connect these models and facilitate macro-parallelization of computations; and a genetic algorithm for evolving fish guidance structure designs based on model simulations. We utilized the BOT to optimize barriers at the Georgiana and Steamboat Slough junctions for early (November–March) and late (January–April) operational windows. Optimized designs increased simulated through-Delta survival for juvenile Chinook salmon by 1.0–6.3%. Relative to a barrier-free baseline, the greatest gains were associated with a bioacoustic fish fence at Georgiana Slough operated during the early period. Our results highlight the dominant role of operational timing, interactions among multiple junctions, and flow-dependent routing dynamics in determining barrier effectiveness.

Primary Author: Shannon Boyle

Affiliation: McMillen

Title: Scaling Collaboration: Lessons from BIL Fish Passage Investments

Key Words: Policy, collaboration, connectivity, interagency

Abstract:

The Bipartisan Infrastructure Law (or Infrastructure Investment and Jobs Act) catalyzed an unprecedented collaboration among federal agencies toward improving fish passage and aquatic connectivity. Unprecedented funding and some mandated coordination and cross-agency learning set the tone promoting much broader and deeper collaboration across agencies with complementary, and sometimes overlapping, authorities, missions, and funding. In a short period of time, agencies came together to consider integrated planning and strategic investments – a shift from historically fragmented approaches. We present a retrospective analysis of lessons learned from this rapid evolution in collaboration. Drawing on examples from across the federal government, we examine how increased funding, compressed delivery timelines, and heightened expectations reshaped coordination among agencies responsible for fisheries management, water and transportation infrastructure, habitat restoration, flood risk reduction, and water quality.. We will reflect on where and why challenges persisted and how regulatory and institutional constraints influenced implementation despite expanded resources. Looking ahead, we explore how insights from the BIL era can inform a more durable and effective framework for advancing aquatic connectivity across agencies with diverse missions and beyond a single funding cycle . By pairing candid reflection with forward-looking dialogue, this presentation aims to identify practical pathways for sustaining and strengthening interagency collaboration, ensuring that the momentum generated under BIL translates into long-term gains for connected aquatic ecosystems and resilient infrastructure.

Primary Author: Cathy Bozek

Affiliation: U.S. Fish and Wildlife Service

Title: Community co-benefits of fish passage and aquatic connectivity projects: case studies and considerations for project design, assessment, and communications.

Key Words: communities, safety, recreation, outreach

Abstract:

Fish passage and aquatic connectivity restoration projects deliver a wide range of benefits. Beyond restoring aquatic ecosystem function and improving passage for aquatic species, these projects enhance ecosystem services and provide other benefits for surrounding human communities. These human-centered outcomes – often referred to as "co-benefits"- can include reduced flood risk, increased infrastructure resilience, improved public safety, expanded recreational opportunities, job creation, and economic development. Effectively delivering, assessing, and communicating about these co-benefits can draw together a larger and more diverse group of stakeholders to build support for individual projects and the overall aquatic connectivity restoration movement. This presentation will explore the range of community benefits associated with fish passage projects, provide examples through case study projects, and describe how practitioners and stakeholders develop, design, and implement projects to optimize both ecological benefits and the co-benefits for people. The presentation will also propose a framework and methods for tracking and evaluating the human-centric outcomes of projects, and highlight the importance of strategic communication about these co-benefits to build support for fish passage initiatives.

Primary Author: Joachim Bretzel

Affiliation: Charles Sturt University; Australasia Fish Passage Services

Title: Fish Entrainment and Intake Screening: Insights from the Australian Experience

Key Words: Entrainment, Fish screens, Pump intakes, Native fish conservation

Abstract:

Many millions of native fish are entrained at water diversions and pumps in Australian rivers every year during the irrigation season. Recent studies have shown that entrainment impacts both stocked and threatened species, and that it occurs in river systems across tropical and temperate regions. Fish screens are increasingly proposed as a management tool to protect fish from this fate. Field studies in the Murray-Darling Basin have investigated fish losses at unscreened offtakes and compared these losses with the performance of different fish screen types, while laboratory studies were conducted to examine interactions of various species with simulated screens. Entrainment at unscreened intakes was significant and has the potential to undermine efforts aimed at native fish recovery, although losses varied widely between locations and pumps. The installation of modern fish screens substantially reduced entrainment across fish numbers and species at different diversion types. Impingement is to some degree species-specific but can be minimized when engineering requirements, such as appropriate velocities at the screen surface, are met. The use of fish protection screens at pump intakes and diversions can therefore reduce fish losses, improve stocking success, and support native fish recovery without affecting water supply. However, several open questions remain and require further investigation for practically applicable fish conservation.

Primary Author: Marybeth Brey

Affiliation: U.S. Geological Survey, Upper Midwest Environmental Sciences Center

Title: Evaluation of an Underwater Acoustic Deterrent System to Control Invasive Carps at a Mississippi River Navigation Lock

Key Words: invasive species, selective passage, time-to-event, acoustic telemetry

Abstract:

Silver carp (Hypophthalmichthys molitrix), Bighead carp (H. nobilis), Black Carp (Mylopharyngodon piceus), and Grass carp (Ctenopharyngodon idella), collectively, invasive carps, are invasive fishes expanding their range in the Mississippi River Basin of the United States. Research has demonstrated that invasive carps are sensitive and responsive to underwater sounds. These signals could be engineered to elicit behavioral responses – potentially deterring fish from moving upstream in rivers with limited effects on native fishes. Deploying and evaluating underwater acoustic deterrent systems (uADS) at large, management-relevant scales, such as at navigation locks, is a necessary step in determining their feasibility and selectivity as a control tool. We will discuss the process from concept and construction to evaluation of a large-scale uADS at Lock 19 on the Mississippi River, USA. For four years, we used two acoustic telemetry arrays (69 kHz and 307 kHz) and over 2700 fish with acoustic transmitters to evaluate the changes in the rates of approach towards and retreat from the uADS, fine-scale behavior, and changes in upstream fish passage all related to uADS operation. Results of ongoing acoustic deterrent research will help managers understand the effectiveness of acoustic deterrents and provide considerations for balancing native fish passage with invasive species deterrence.

Primary Author: Rocko Brown

Affiliation: Cramer Fish Sciences

Title: Incorporating Fluvial Geomorphology into the Design of Water Diversions to Enhance Salmon Passage in California's Central Valley

Key Words: geomorphology, diversion, riffle

Abstract:

Water diversions represent fixed infrastructure within dynamic river corridors, creating inherent conflicts where fluvial processes drive channel evolution. In California's Central Valley, these conflicts can limit habitat restoration if fluvial processes and trends are not explored and leveraged during the design process. This talk demonstrates how understanding geomorphic settings—including aggradation and degradation patterns, channel meandering, bifurcation dynamics, and riffle-pool sequences—is crucial for designing diversions that work with, rather than against, natural river processes. By strategically siting diversions relative to bar-pool complexes and bifurcation nodes, designers can leverage natural hydraulic complexity to improve fish passage while maintaining infrastructure functionality over relatively long time horizons. The presentation explores how riffle-pool-bar mechanisms and bifurcation dynamics create opportunities for self-sustaining passage corridors that accommodate both the river's tendency to adjust its planform and the operational requirements of water extraction. When integrated with modern fish screening technology, these geomorphically-informed designs reduce maintenance costs, minimize unnatural predator-prey dynamics at diversion sites, and enhance habitat quality throughout the salmonid life cycle. Attendees will gain practical insights into designing resilient water infrastructure that balances ecological function with agricultural and municipal water needs in morphologically evolving river systems.

Primary Author: Kirsten Brudevold

Affiliation: Colville Confederated Tribes - P2IP

Title: Returning Salmon to Traditional Habitats in the Upper Columbia: Adult Trap and Transport – Investigating the Feasibility of Salmon Reintroduction

Key Words: Grand Coulee Dam, Columbia River, Trap & Transport, P2IP, Salmon Reintroduction

Abstract:

Adult salmon trap and transport upstream of Chief Joseph Dam (CJD) and Grand Coulee Dam (GCD) has played a vital role in salmon reintroduction to the upper Columbia. Small ceremonial releases of surplus hatchery Chinook (Oncorhynchus tshawytscha) have expanded into reintroduction pilot projects supporting the feasibility evaluations of permanent fish passage facilities. The Columbia River was once one of the most productive salmon rivers in the world. After the construction of GCD in the 1940s much of the primary salmon habitat was obstructed. Restoring access to the blocked area will have many ecological, cultural and recreational benefits. The program's trap and haul efforts paired with strategic tagged releases have helped determine fish behavior in the mainstem and its tributaries. Surplus hatchery origin chinook collected at downstream facilities undergo robust bio-sampling (PBT, IHNV pathogen) and occasional acoustic and PIT tag installation before being loaded onto a transport truck. Water quality (temperature, dissolved oxygen) and fish density are closely monitored during transport to mitigate stress. The Chinook are transported to many different release sites across 100's of miles of receiving waters including dam forebays, reservoir boat launches and remote tributary access points . Acoustic tracking surveys have documented survival and behavior as the fish acclimate and seek suitable spawning habitat. Spawning ground surveys have proved transport survival and successful spawning activity. Two of the local tributaries are equipped with a rotary screw trap (RST) confirming successful reproduction. In 2025, a blocked area natural-origin Chinook returned to the upper Columbia as an adult and migrated as far as CJD. Trap and transport has been a tremendous tool for us to begin the reintroduction process in a relatively quick and inexpensive manner while we engage in the long-term complex process of evaluating the feasibility of permanent fish passage at these high head structures.

Primary Author: Norman Buccola

Affiliation: U.S. Army Corps of Engineers, Portland District

Title: Total Dissolved Gas Dynamics in the North Santiam River, Oregon

Key Words: TDG, North Santiam River, Gas saturation

Abstract:

Elevated Total Dissolved Gas (TDG) is a concern for fish downstream of Detroit and Big Cliff dams on the North Santiam River, Oregon listed under the Endangered Species Act (ESA). When TDG levels exceed 125%, fish may develop barotrauma or gas bubble disease. These elevated levels typically occur during "spill", when water bypasses power outlets due to equipment outages, water temperature management, downstream fish passage, or high-flow conditions that exceed powerhouse capacity. The Big Cliff TDG abatement structure was required for compliance with the ESA. The innovative structure was designed with the express purpose of dissipating TDG and consists of a straight, cross-channel rock weir structure spanning the width of the North Santiam River immediately below Big Cliff Dam with a 10H:1V backslope, a 50-foot long horizontal bench, followed by an additional 10H:1V backslope. The mild slope was designed to promote whitewater and bubble generation, while the bench was intended to prevent any bubbles that are generated from plunging to depth and increasing TDG. Prior to the abatement structure construction, a network of real-time TDG monitors was installed and used in combination with dam operations data to develop emperical TDG models through statistical analysis. These models will be applied and compared to the post-construction period data to assess the effectiveness of the prototype structure under identical upstream dam operations, allowing an objective and thorough evaluation of the need for further construction implementation.

Primary Author: Michael Burke

Affiliation: Inter-Fluve

Title: Ten Years After – Insights from a Decade of the Howland Fish Bypass Channel

Key Words: nature-like, large-scale, monitoring, evolution

Abstract:

The Howland fish bypass channel on the Piscataquis River in Maine is one of the largest nature-like fishways in North America, and is an important component of the Penobscot River restoration. The bypass channel was commissioned in autumn 2015 with the goal of providing safe, timely, and effective passage for Atlantic coast diadromous species. Over the last decade, the bypass channel has evolved along a stable, maturing trajectory relative to the newly constructed condition. Following an expected initial adjustment of the blended well-graded, large boulder-dominated substrate, the constructed bed has adjusted in subtle ways while maintaining diverse flow patterns and fish passage opportunities. The channel has intermittently processed large wood material and transient sediment without problematic channel deformation or owner intervention. In recent years, recruitment of native riparian trees to the high flow margins has added a truly natural riparian character to the channel. Importantly, the stability of the hydraulic inlet has continued to maintain the minimum water surface elevation of the headpond, a critical success criterion. Physical monitoring measurements and repeat photography collected in the first three years and again in the tenth year following commissioning, along with ongoing observations and biological assessments, yield insights on the evolution of the project, contributing to the knowledge base for large-scale nature-like fish passage design and implementation.

Primary Author: Michael Burke

Affiliation: Inter-Fluve

Title: Milltown Dam Decommissioning and Removal – Reconciling modern fish passage design criteria and compliance needs with historical fish passage characteristics at Salmon Falls, St. Croix/Skutik River

Key Words: decommissioning, dam removal, international, cooperation

Abstract:

The Milltown Generating Station was the oldest operating hydroelectric facility in Canada, the lowermost barrier on the St. Croix River (Skutik) River which forms the border of Maine and New Brunswick. The generating station was located at the site of the historic Salmon Falls, a site of utmost cultural significance for the Peskotomuhkati (Passamaquoddy) people. The watershed has the potential to support the largest run of migratory river herring on the east coast, with an estimated population capacity of 20-60 million fish. However, for over a century, sea-run fish passage on the lower St. Croix has been impeded at Milltown, along with two additional upstream mainstem dams, and at multiple tributary barriers. Several substantial challenges were overcome in realizing the decommissioning and removal project, completed in Fall, 2024, an example of exceptional international cooperation. Not the least of these challenges was navigating the complexities of designing and implementing a major dam removal along a transboundary river, with an international border running through the power station, subject to the regulatory jurisdictions of two nations, one province, one state, and two towns. One additional challenge requiring care was to reconcile assurance of safe, timely, and effective passage at the site to meet regulatory and compliance needs with the historical fish passage context of the site. Although compliance is commonly evaluated with modern fish passage engineering design criteria, it is unlikely that Salmon Falls historically met those criteria in a comprehensive manner. Yet, the site historically supported native sea-run fish populations of extraordinary abundance. This juxtaposition that occurs with frequency at sites across North America will be explored in this presentation, along with other details of this landmark project.

Primary Author: Colleen Burliuk

Affiliation: Innovasea

Title: Monitoring Downstream Eel Passage Through a Hydro-Facility using Acoustic Fine-Scale Positioning

Key Words: Acoustic Telemetry, Migration, Hydro, American eel

Abstract:

Fine-scale positioning was used to document the route of downstream passage of acoustically tagged adult American eels (Anguilla rostrata) at Nova Scotia Power Inc. (NSPI) hydro-facilities on the Mersey River, Nova Scotia, Canada. Fine scale positioning uses hyperbolic positioning, also known as time difference of arrival (TDOA). It is an analytical method that measures the difference in transmission detection times at pairs of time-synchronized receivers and converts these to distances using the signal propagation speed. A tag transmission must be detected on three or more receivers for positioning to be possible. Three separate fine-scale positioning arrays were installed at hydro-facilities where the spillway and turbine were contiguous. As a mitigation measure to provide alternate downstream passage at its facilities, NSPI spilled at each facility from September 20 to November 14 to facilitate the successful downstream migration of eels. A total of 39 Innovasea 307 kHz-HR3 receivers were installed throughout the river, covering ~31 km. 100 eels were implanted with 795-LF 307 kHz acoustic transmitters and were monitored from September to December 2024. The fine-scale positioning array at the most upstream facility successfully tracked 87 out of 89 detected eels. This detailed positioning data was essential for determining each eel's route, particularly in relation to the nearby powerhouse and spillway. The technology serves as a key component of the company's strategy to evaluate mitigation measures aimed at reducing turbine-related mortality in eels.

Primary Author: Kelly Campbell

Affiliation: University of Illinois Urbana-Champaign

Title: Integrating swimming energetics of blue catfish (Ictalurus furcatus) into biologically informed fish passage design on the Mississippi River.

Key Words: swimming energetics, fish passageway design, telemetry, blue catfish

Abstract:

Dams have significantly altered freshwater landscapes and aquatic ecosystems across the United States by fragmenting habitats, impeding fish migration, and altering water flows and sediment movement. The Upper Mississippi River and Illinois Waterway houses 37 locks and dams and nearly an equal number of migratory fish species (34), representing a fragmented system inherently at odds with some of its most mobile inhabitants. Fish passageways are a tool being used by the U.S. Army Corps of Engineers (USACE) to restore habitat connectivity for these migratory species. However, most fish passageways across the United States have been designed based on philopatric salmonids and bear little biological relevance for the non-salmonids moving throughout the Mississippi. An informed fish passageway design for these species is hindered by knowledge gaps in fish movement and behavior, and how fish passageway design elements impact swimming energetics and fish passage. We aimed to inform fish passageway design on the Mississippi River by defining the energetic cost of swimming for blue catfish (Ictalurus furcatus), a species of significant ecological and socio-economic value, across water velocities and in the presence or absence of in-stream structures at two ecologically relevant temperatures (12 and 22 °C; n = 7 fish per group). For this, we first used accelerometry and respirometry to relate swimming energetic cost to acceleration in a 185-L swim tunnel. Next, we conducted swim trials in a ~125,000-L flume to quantify impacts of in-stream structures on swimming energetics at different flow velocities. These studies were designed in close collaboration with USACE and leveraged resources and partnerships from across the Mississippi River Basin. Our research outputs will help define swimming energetics for an important migratory species and identify fishway design elements which will aid in its successful fish passage.

Primary Author: Jade Carver

Affiliation: Pacific Northwest National Laboratory

Title: Assessing Juvenile Salmon Response to Shear Stress to Inform Dam Passage Design

Key Words: hydraulic stressors, salmon, fishway design, balloon tagging

Abstract:

Juvenile salmon may encounter intense hydraulic stressors, including shear flow conditions (i.e., adjacent fluid layers moving at different velocities), during downstream passage at dams, potentially leading to injury or mortality. Understanding how juvenile salmon respond to shear stress is critical for improving fish passage in regulated river systems, such as the Howard A. Hanson Dam (HAHD) on the Green River (Washington State, USA). To support the design of a fish passage facility (FPF) at HAHD, laboratory experiments were conducted to evaluate injury and survival of juvenile salmon exposed to controlled shear conditions. Testing was conducted at the Pacific Northwest National Laboratory (PNNL) shear flume between October and December 2024. Juvenile Chinook (Oncorhynchus tshawytscha; n = 500) and coho (O. kisutch; n = 400) salmon were exposed to flows ranging from 10 to 70 feet per second, representing shear conditions that may be encountered during dam passage. Prior to exposure, a subset of Chinook (n = 248) and coho (n = 211) salmon were fitted with balloon tags, an increasingly common tool used in field studies for fish recollection and evaluation of downstream passage survival. High-speed video was used to verify exposure and document fish behavior during each trial. Fish underwent detailed health assessments and were monitored for 48 hours following exposure to evaluate delayed injury or mortality. Results from this study can help identify shear stress thresholds associated with injury or mortality in juvenile salmon and inform design considerations for fish passage systems at HAHD and similar dams. Additionally, the study provides baseline biological response data that support interpretation and calibration of other methods used to assess downstream fish passage injury and survival.

Primary Author: Jean Castillo

Affiliation: NOAA Fisheries

Title: NOAA Fisheries Fish Passage Guidelines and Design-Review Process

Key Words: guidelines, design standards, fish passage

Abstract:

NOAA Fisheries has developed a suite of fish passage guidelines to provide project managers, engineers, biologists and project proponents with the latest information and best practices for designing fish passage facilities and road crossings. This talk will introduce the current 5 documents briefly touching on capstones of each along with sharing any new guidance that may have transpired since the submittal of this abstract.

Primary Author: Jake Cavaiani

Affiliation: Pacific Northwest National Laboratory

Title: Evaluation of Nighttime Spillway Operations for Fish Passage at Foster Dam

Key Words: survival, spillway operations, radio telemetry

Abstract:

The development and operation of hydroelectric and flood risk management dams have adversely affected salmon and steelhead populations in the Willamette River Basin (Oregon, USA). Foster Dam, operated by the U.S. Army Corps of Engineers (USACE), is a multipurpose dam located on the South Santiam River (Sweet Home, Oregon) that acts as a physical barrier for fish migrating up or downstream. However, specific spillway operations may help increase dam and reach survival rates of downstream migrating fish. Since 2022, the Pacific Northwest National Laboratory has been conducting studies to evaluate dam passage and reach survival during different spillway operations as a benefit for passing juvenile Chinook salmon (Oncorhynchus tshawytscha) and winter steelhead (O. mykiss). The main objective of this study was to determine if nighttime spillway operations led to higher dam and reach survival rates compared to daytime turbine operations. To achieve these goals, a radio telemetry (RT) system was deployed to track RT-tagged fish at nine locations across the Santiam and Willamette rivers. We evaluated dam passage survival to the first detection array downstream of Foster Dam while reach survival was measured to the confluence of the Santiam River with the mainstem Willamette River. Findings indicated higher survival rates during nighttime spillway operations for both Chinook salmon and steelhead. Most fish passed at night, likely influenced by factors such as discharge, water temperature and predator avoidance. These results highlight the effectiveness of nighttime spillway operations compared to daytime turbine passage for downstream-migrating juvenile salmonids and will guide future USACE operational strategies for promoting higher survival rates for migrating fish.

Primary Author: Robert Chase

Affiliation: HDR Engineering, Inc.

Title: The New Sacramento Weir: An advanced fishway passage facility integrated into a modern floodway project

Key Words: Floodway, Sturgeon passage

Abstract:

The 109-year-old existing Sacramento weir is receiving an upgrade with a new expansion weir and fish passage facility. The upgrade includes the new widening of the existing weir of approximately 1,500 ft. This includes re-alignment of the current county road, passive flow through the weir, drainage connection from existing basin and a double notch hybrid technical fishway. The fishway consists of both a fish ladder and open fish passage channel. The facility is designed to pass adult sturgeon during upstream up migration to the Sacramento River. While providing downstream passage for juvenile salmonids. Within the passage facility multiple monitoring methods will be utilized that include but are not limited to, ARIS camera monitoring, PIT tag array, and acoustic monitoring array. Current research and tagging efforts are underway that will complement the facilities monitoring objectives. The presentation will highlight the features of the facility, discuss the unique aspects of providing passage during flood events, and offer lessons learned from the collaborative process of building multi-benefit structures that protect both human and fisheries communities during challenging conditions.

Primary Author: Utashi Ciraane

Affiliation: University of Liege

Title: Model assessing the suitability of river flows for Atlantic salmon smolts

Key Words: Smolt, Ecohydraulic, Ethohydraulic, Fish passage, Hydropower

Abstract:

Several hydrodynamic criteria have been proposed to improve the downstream migration of Atlantic salmon smolts in human-altered rivers. These criteria are often applied in fine-scale models that simulate smolt behaviour depending on flow conditions. However, the use of such individual-based models frequently requires specialised expertise and important computation resources. In this paper, a model that shifts attention from fish behaviour to flow characteristics is introduced. By combining established hydrodynamic criteria for effective smolt migration namely: water velocity, water depth, spatial velocity gradient, and turbulent kinetic energy, it provides a simple yet robust method for assessing the suitability of river flows for juvenile Atlantic salmon. Application of the model at three hydropower plants on the Ourthe River in Belgium revealed strong agreement between model outputs and observed smolt trajectories. These findings demonstrate the model's value as an efficient proxy for site assessment and for analysing potential measures to improve the downstream migration of smolts in anthropized rivers.

Primary Author: Theo Claire

Affiliation: California Department of Water Resources

Title: Juvenile Salmonid Collection System: Results from Pilot Study to Test New Methods in Juvenile Chinook Salmon Capture on the Winnemem Waywaket

Key Words: reintroduction, juvenile collection, traditional ecological knowledge

Abstract:

Juvenile collection represents the most challenging aspect of trap-and-haul efforts to reintroduce Pacific salmon above passage barriers, often characterized by inconsistent trap efficiencies and significant stress impacts to juvenile fish. DWR deployed the Juvenile Salmonid Collection System on the McCloud River Arm of Shasta Reservoir for four seasons of field operations between 2022-2025 to test new methods in juvenile collection and support CDFW, NOAA Fisheries, and the Winnemem Wintu Tribe in the effort to reintroduce winter-run Chinook Salmon to the Winnemem Waywaket (McCloud River) above Shasta Dam. DWR tested two iterations of the JSCS: a net-based floating surface collector deployed in head-of-reservoir conditions 2022-2024 (the JSCS) and a louver-based floating surface collector deployed in riverine conditions 2025 (the JSCS V2). The JSCS achieved acceptable trap efficiencies (>10%) only in a very narrow range of conditions (depth: 10-15 feet; velocity: 1-2 fps) and the nets proved difficult to operate, forming gaps in slow water and billows in high flows. The JSCS V2 outperformed the previous trap iteration, achieving an average trap efficiency of 15.49% with a maximum recapture rate of 47% and successfully fishing through three storm events with flows >1,100 cfs. We found that deploying a temperature curtain effectively moderated water temperatures and encouraged mixing in stratified head-of-reservoir conditions, but that the Winnemem Waywaket generally had superior water quality compared to Shasta Reservoir and that such interventions were unnecessary when operating the JSCS V2 in the river. Predation by non-native fishes, especially Spotted Bass, also decreased in the river compared to the reservoir. A collaborative partnership between DWR and the Winnemem Wintu Tribe for the design and operation of the JSCS V2 generated new methods in juvenile trapping and sampling (e.g., use of willows; the "fish viewer") which improved trap performance and decreased stress on juvenile salmon.

Primary Author: Dave Coffman

Affiliation: RES

Title: Restoration at Scale: Ecological renewal and reconnection with the Klamath River Renewal Project

Key Words: Dam Removal, Restoration at Scale

Abstract:

Removal of four hydropower dams on the Klamath River in northern California and southern Oregon is the largest dam removal and river restoration project in the country. Tribal communities had long advocated for an undammed and restored river, citing the negative impacts on Tribal fisheries, health, and culture. After decades of advocacy and work, in Fall 2024, dam removal was achieved. The historic project restored free-flowing conditions and volitional fish passage to hundreds of miles of the Klamath River, once the third largest producer of salmon on the West Coast, and is leading to landscape level change seldom seen in a single project. The Klamath River Renewal Corporation selected RES to lead restoration for this ambitious effort, as well as accept liability associated with ensuring restoration meets ecological and biological performance standards and long-term goals/objectives. This presentation provides a look at the landscape scale change that has occurred over the past two years from the project, approaches used for restoration and lessons learned, fish passage monitoring conducted, and will provide an update on the tributary restoration actions undertaken since the dams were removed.

Primary Author: Warren Colyer

Affiliation: Trout Unlimited, Inc.

Title: Barrier removal to increase flood and fire resiliency – is that a thing?

Key Words: barrier removal, climate resiliency

Abstract:

The field of stream restoration has advanced significantly in recent years as practitioners increased their understanding of how streams historically interacted with their valley bottoms prior to anthropogenic influences. The focus on engineering stable channels has shifted to restoring the processes that create integrated river-floodplain networks, or riverscapes. These complex systems create inefficient flow paths and store water on the landscape longer through groundwater infiltration, frequent floodplain inundation and ponding. These features create habitat complexity for fish and wildlife, while increased inundation area and shallow groundwater can result in resiliency co-benefits, including flood attenuation and drought resistance. Another potential co-benefit that has emerged more recently is wildfire resilience, as wet meadows, beaver ponds and healthy riparian corridors resist burning and provide refuge for plants and animals during wildfires, and can help to assimilate the post-fire pulses of sediment and ash that often flow into streams when rain and snow interact with fresh burn scars. This restoration of stream processes often focuses on adding wood (e.g., beaver dam analogs, post-assisted log structures, log jams) and/or fill (e.g., stage-0 restoration) to re-connected floodplains. Less discussed in the riverscape context is the practice of removing dams and barriers to restore what is arguably the most important river process of all – free-flowing water. In this presentation we will consider the role of dam and barrier removal in riverscape restoration, and specifically the contribution of these projects to flood and fire resiliency. We will use case studies to demonstrate that dam and barrier removal is an important tool for restoring healthy riverscapes and increasing climate resiliency.

Primary Author: Erin Connor

Affiliation: U.S. Bureau of Reclamation

Title: Leveraging High-Speed Particle Tracking to Assess Fish Passage Facility Performance

Key Words: Juvenile Fish Passage, Hydraulic Modeling, Flow Visualization

Abstract:

A 1:10 scale physical model was developed at the Bureau of Reclamation Hydraulics Laboratory to refine hydraulic conditions for a proposed downstream juvenile fish passage facility. High-speed videos of neutrally buoyant polymer particles provided detailed visualization of flow patterns and proximity to gate structures. While flow visualization using tracer particles is an established technique, this study represents a unique implementation to quantify potential gate interactions fish might experience. Analysis using OpenCV-based tracking algorithms combined with further post-processing generated trajectory data, heatmaps, and proximity metrics to assess fish impact risk. Limitations included out-of-plane ambiguities and tracking challenges under occlusion. Future work will enhance optical setups, predictive tracking, and statistical robustness. This integrated approach advances understanding of hydraulic conditions critical for safe and effective fish passage.

Primary Author: Lis Cordner

Affiliation: Cramer Fish Sciences

Title: Predator Hotspots and Passage Solutions: Improving Salmon Survival at Central Valley Diversions

Key Words: predation, diversions, entrainment

Abstract:

Poorly configured water diversions in highly modified California Central Valley rivers can create ecological bottlenecks for migrating salmon, where altered hydraulics, diversion canals, irrigation ponds, and associated structural features increase both entrainment potential and exposure to predation. Traditional diversion configurations often produce deep, low-velocity habitats and channel-spanning features that concentrate non-native predators and increase outmigrating juvenile salmon entrainment and mortality risk. This talk presents an integrated field approach for assessing predator–prey dynamics near diversion infrastructure using snorkel surveys, tethered-fish predation trials, and targeted video monitoring to identify where, when, and by which species predation occurs. Across diversion settings, predator observations and predation events were frequently associated with hydraulically altered zones adjacent to diversion structures, where depth and velocity conditions tend to favor ambush predators and may influence juvenile salmon movement behavior. We contrast these patterns with in-channel cone screen diversion designs that withdraw water while maintaining main-channel continuity. Preliminary observations suggest these configurations reduce entrainment potential and may limit the extent of slackwater and structural features commonly used by predators. Attendees will learn how diversion design influences the ecological conditions fish encounter during migration and how science-informed engineering approaches can support restoration and remediation efforts aimed at improving salmon survival in managed river systems.

Primary Author: Claire Couch

Affiliation: U.S. Geological Survey

Title: Adult Mortality as a Limiting Factor in Reintroduction Success: A Willamette Basin Case Study

Key Words: Chinook salmon, trap-and-haul, pre-spawning mortality, disease, temperature

Abstract:

Mortality of adult salmon that occurs during freshwater migration (en route mortality) and prior to spawning (prespawning mortality) can severely limit population productivity for salmon reintroduction programs. Adult mortality is becoming increasingly common throughout the range of Pacific salmon and has been documented extensively in the Willamette River Basin. In tributaries of the Willamette River, reintroduction programs implemented using trap-and-haul have experienced abnormally high rates of prespawning mortality, leading to research focused on identifying causal mechanisms. This presentation will distill findings from numerous studies in the Willamette Basin along with relevant observations from other basins to advance the state of knowledge on factors related to adult salmon mortality. We describe how key factors (i.e., thermal exposure, disease, human disturbance) interact to shape patterns of adult mortality, and how natural resource managers have attempted to address some of these factors. As adult mortality becomes more common and environmental conditions become increasingly challenging, decision-makers may be faced with difficult choices regarding management alternatives, including the development of fish passage at dams. Adult salmon will likely become more vulnerable to passage mortality as environmental conditions in migration corridors and spawning areas become more stressful. Conversely, providing access to cool, undisturbed, high-quality habitat upstream of dams can help reduce adult mortality as available downstream habitat decreases. Mitigating adult salmon mortality, especially in the context of reintroduction, requires understanding of the combination of stressors faced by adult fish during the entire period leading up to spawning, including migration, passage, and holding. In several instances, managers have been able to reduce adult mortality by mitigating stressors at various points during the adult freshwater life stage, but there is no one-size-fits-all approach, and the best mitigation strategy depends on the unique combination of stressors present in each system.

Primary Author: Alex Coulling

Affiliation: Kleinschmidt Associates

Title: Alternatives Analysis and Feasibility Studies for Fish Passage Projects

Key Words: Alternatives Analysis, Feasibility Studies

Abstract:

Fragmentation of rivers by dams, road-stream crossings, and other infrastructure remains a primary constraint to fish movement throughout a given watershed. While fish passage projects offer substantial ecological benefits, they are frequently challenged by complex and unique site conditions, competing stakeholder objectives, regulatory requirements, and funding limitations. Robust alternatives analysis and feasibility studies are therefore critical to informing decision-making and advancing projects from concept to final design and construction. This presentation describes a structured framework for conducting alternatives analysis and feasibility studies for fish passage projects. The approach integrates biological objectives, hydraulic and site constraints, constructability, operation and maintenance costs, risk, and regulatory considerations. Early definition of project goals and identification of the site-specific constraints described above is critical, followed by systematic screening of feasible alternatives including technical fishways, nature-like fishways, hybrid options, as well as full or partial removal of the dam. The methodology uses desktop screening, field investigations, hydrologic and hydraulic modeling, geotechnical investigations, and cost estimating to compare alternatives objectively. A scoring matrix is used to evaluate the pros, cons, and tradeoffs among the different options for anticipated effectiveness, risk, capital cost, operations and maintenance cost, and stakeholder acceptance. Documentation of these studies provide historical context for options considered and discussions regarding decisions made to pursue a particular option. By implementing this initial step, project teams can improve outcomes, manage risk, and accelerate delivery of fish passage improvements. The framework presented is adaptable to a wide range of project sizes and settings and provides a practical roadmap for consultants, utility owners, regulatory agencies, and non-profits working to improve fish passage connectivity.

Primary Author: Natasha Coumou

Affiliation: Tulalip Tribes of Washington

Title: Many Barriers, One Vision: Reconnecting the rivers of Tulalip's Ancestral Lands

Key Words: Tribal co-management, salmon recovery, stream reach coordination, novel approach

Abstract:

Anadromous salmon are central to the cultural, spiritual, and subsistence practices of Tribal Nations in Washington State. As a federally recognized Tribe with salmon co management authority, the Tulalip Tribes have taken a leading role in understanding and addressing fish passage barriers that limit recovery of threatened salmon populations. Beginning in 2021, the Tulalip Tribes launched a coordinated, region wide effort to accelerate fish barrier removal across the Stillaguamish and Snohomish watersheds; two major Puget Sound river systems that once sustained abundant Chinook and Coho salmon, now listed under the Endangered Species Act. These watersheds contain thousands of barriers across mixed ownerships and jurisdictions, making it difficult to prioritize projects and achieve basin scale recovery. Traditional "most downstream first" strategies have resulted in slow progress, with fewer than ten barriers removed annually. Recognizing this limitation, the Tulalip Tribes introduced a novel stream reach coordinated approach designed to open the greatest amount of habitat possible by treating clusters of barriers within a reach, regardless of ownership or implementation sequence. This approach emphasizes collaboration, shared knowledge, and strategic leveraging of existing funding and staff capacity. Since 2022, the Tulalip Tribes working with eight local governments and nonprofit organizations have secured over $30 million in competitive funding for fish passage projects. Together, these partners are advancing projects that will remove more than 40 barriers, reconnect hundreds of miles of habitat, and expand basin wide barrier inventories to inform future work. The new projects were added to current fish passage targets. This collaborative model has united stakeholders across jurisdictions and created a scalable strategy for accelerating barrier removal at a meaningful ecological pace. By shifting from fragmented, project by project efforts to an integrated stream reach framework, the Tulalip Tribes demonstrate a transformative pathway for restoring salmon habitat and supporting Tribal co-management responsibilities in their Usual and Accustomed fishing areas.

Primary Author: William Cowan

Affiliation: California Department of Fish and Wildlife

Title: Use of green wave-length lidar for two-dimensional hydraulic modeling for Clear Lake Hitch passage, Lake County, CA

Key Words: fish passage, lidar, two-dimensional modeling, Clear Lake Hitch

Abstract:

Lidar is a useful technology when evaluating fish passage on a watershed scale. Clear Lake in Lake County, California, is home to the Clear Lake Hitch (CLH), a minnow species that migrate from the lake in spring to tributaries for adult spawning and juvenile rearing before returning to the lake in early summer. The Clear Lake Hitch, known as chi, are of great cultural significance to seven federally recognized Tribal Nations in the Clear Lake region: Big Valley Band of Pomo Indians, Elem Indian Colony, Robinson Rancheria of Pomo Indians, Habematolel Pomo of Upper Lake, Scotts Valley Band of Pomo Indians, Middletown Rancheria of Pomo Indians, and Koi Nation. Lidar was used to develop 2D digital elevation models to evaluate CLH passage in six priority tributaries to the watershed. Green wave-length was added to the bare-earth lidar to improve resolution of areas inundated during the lidar flight. Story cover, instream/near stream vegetation, and instream structures like bridges limit lidar resolution. Deeper water depths and turbidity limit the resolution of the green wave-length. The lidar returns from the six tributaries contained voids and artifacts in the original raster surface. Traditional topographic survey methods, RTK-GPS and total station, were used to fill in voids and correct artifacts in raster surface. Flow simulations were conducted using both the raw and corrected raster surfaces. The corrected raster surface improved model water surface elevation calibration and eliminated instream passage impediments that were products of artifacts in the raw raster surface.

Primary Author: Rachel Crawford

Affiliation: Earth Sciences New Zealand/ University of Waikato

Title: Teaching fish new tricks: Repeated exposure to a velocity barrier improves passage performance

Key Words: passage performance, migratory behaviour, learning and cognition

Abstract:

Instream structures like culverts and dams can impede upstream fish migration, acting as environmental filters that only allow onward migration of individuals that can successfully pass them. Cognition and learning ability may be important factors in determining if a fish can successfully traverse such structures. This study investigated the effect of repeated exposure on passage performance of juvenile Galaxias maculatus, a diadromous fish native to New Zealand, through an experimental raceway. Over five consecutive days, individual fish were subjected to 0.45–0.5 m s-1 water velocity within the raceway, and performance on each day was recorded. This velocity range is higher than the preferred velocities for the species. The proportion of fish successfully passing the barrier increased significantly from 40% on Day 1 to 63% on Day 5. Time-to-event analysis further revealed that by Day 5, fish successfully passed the barrier at a significantly faster rate compared to Day 1. However, repeated exposure did not significantly improve approach or entry rates into the raceway. Fish length influenced approach and passage rates, but not entry rate. These findings suggest that cognition and spatial memory play a role in improving passage performance through velocity barriers, but other factors such as attraction flows and fish size may also play important roles in successful passage outcomes.

Primary Author: David Creamer

Affiliation: Michigan State University

Title: Can Antipredator Cues and Attractant Flows Facilitate Selective Guidance and Removal of a Migratory Invasive Fish?

Key Words: Selective Fish Passage, Invasive Species, Alarm Cue, Attractant Flow

Abstract:

The Great Lakes ecosystem is at risk from the twin threats of invasive species and habitat fragmentation due to dams. Dam removal can restore connectivity, but by blocking access to riverine habitats, dams also play an important role in controlling damaging invasive species such as sea lamprey (Petromyzon marinus). This “connectivity conundrum” has led managers to call for the development of novel selective fish passage devices that will allow the passage of desirable fishes while blocking and capturing sea lamprey. We conceived a two-channel selective fish passage device that blocks sea lamprey (SL) from moving upstream through a fishway or “pass channel” while guiding them toward a secondary “trap channel” containing an eel ladder ramp trap. We utilized the SL’s natural attraction to flow and turbulence (attractant flow) and a species-specific repellent (alarm cue) to manipulate their swimming behavior to achieve these outcomes. We tested if 1) alarm cue can guide SL away from the pass channel, 2) attractant flow can guide SL to the trap channel, and 3) if the combination of these treatments increased SL captures. We evaluated our selective fish passage concept under four treatment conditions at Hammond Bay Biological Center, varying the presence and absence of alarm cue and/or attractant flow between treatments. Pit tagged SL were tracked via an antenna array, with time to event analysis used to interpret the resulting movement record. We found that 1) the presence of alarm cue increased the likelihood SL would leave the pass channel and increased retention in the trap channel 2) attractant flow did not influence SL entrances into the trap channel, but it did increase retention in the trap channel 3) The combination of both treatments resulted in the highest number of ascension attempts and captures on the eel ladder trap.

Primary Author: Dennis Daw

Affiliation: Upper Snake River Tribes Foundation

Title: A Path forward for restoring Salmon in the Snake River

Key Words: Snake River, habitat modeling

Abstract:

Prior to European contact and development there were an estimated 10-16 million salmon and steelhead that returned to the Columbia River system, of those an estimated 1.7 million would have migrated to the Snake River and tributaries above the Hells Canyon complex of dams.Between the 1890's to 1960's a series of hydroelectric and irrigation storage dams were constructed in the Snake River and all the major tributaries, except the Weiser. The first dam to be built in the Snake River basin was the Bruneau Dam, completed in 1892. Over the next 50 years the Bureau of Reclamation constructed dams on all the major tributaries to the Snake River, none of were built with any type of fish passage. The final nail in the coffin that eliminated anadromous fish in the Upper Snake River was the construction of the Hells Canyon Complex, constructed by Idaho power in the late 1950's and early 1960's. USRT and member tribes completed a loss assessment that estimated the distribution within the tributaries of the estimated 1.7 million anadromous fish in the Snake River basin. USRT and member Tribes worked with USGS to complete a current habitat assessment that modeled the spawning and rearing habitat that is still present within each of the major tributaries to the Snake River upstream of HCC and federal dams. The availability of habitat varied depending on species, tributary and location. Identifying habitat suitability and availability for anadromous salmonids in their historical habitats is a critical strategy for ecological restoration, salmon recovery, and cultural revitalization. We have provided a robust set of models to inform and guide effective science-based reintroduction efforts and management decisions in the Snake River upstream of the Hells Canyon Complex and tributaries upstream of federal dams.

Primary Author: WJJ de Bruijne

Affiliation: OAK Consultants BV

Title: From Concept to Construction: Lessons Learned from a decade of Developing the Fish Migration River.

Key Words: Fish Migration River Fishway design project planning

Abstract:

The Afsluitdijk, separating the Wadden Sea from Lake IJsselmeer, represents one of the largest remaining fish migration barriers in the Dutch Delta and the wider Rhine basin. To restore longitudinal connectivity between marine, estuarine, and freshwater systems, the Fish Migration River (FMR) is being constructed at the Kornwerderzand sluice complex. Upon completion in 2027, the FMR will be the largest fishway in the world.The Fish Migration River is a 4-km-long nature-like fish passage operating under tidal influence, designed to accommodate a wide range of target species, from small tidal migrants to large salmonids. Bidirectional flow driven by the tidal cycle enables passage under highly dynamic hydraulic conditions, while providing a diversity of habitats and transition zones that support migration, temporary residence, and acclimatization to freshwater.This presentation reflects on more than ten years of studies, project development, design, and construction of the Fish Migration River. It synthesizes key lessons learned during the planning and implementation phases, including the integration of fish biological requirements with large-scale hydraulic engineering, stakeholder coordination, and adaptive design under tidal conditions.In parallel with construction, an extensive, integrated monitoring and evaluation program has been developed in collaboration with governmental agencies, research institutes, universities, and non-governmental organizations. The monitoring framework aims to assess (1) overall fish passage at the Kornwerderzand complex, (2) attraction efficiency of the Fish Migration River, (3) passage efficiency through the system, and (4) the use of the fishway as habitat and acclimatization area. Opportunities for fundamental research on fish behaviour in tidal fish passages are also explored.By presenting the accumulated knowledge and lessons learned, this contribution provides insights relevant to the design, implementation, and evaluation of large-scale fish passage solutions worldwide.

Primary Author: Angela De Palma-Dow

Affiliation: Lake County Land Trust

Title: Fish Passage Improvements on Manning Creek as Part of the Kuhlanapo Wetland Preserve Restoration Project

Key Words: Fish passage as part of restoration, Dam or barrier removal, Tribal engagement and involvement, Fishway hydraulics and design

Abstract:

The purpose of this Project funded by CDFW is to develop and permit a design to restore the 287-acre Kuhlanapo Wetland Preserve (Preserve) including restoring Manning Creek, an important spawning stream for Clear Lake hitch (hitch; Lavinia exilicauda chi), an endemic Clear Lake minnow which was listed as Threatened under the California Endangered Species Act (CESA) in 2014. The Project will focus on improving fish passage within the Manning Creek lower subwatershed, re-connecting a historical tributary to a wetland and Clear Lake, and restoring native vegetation while suppressing invasive species. This Project is on the ancestral lands of the Kuhlanapo, who stewarded the land prior to the arrival of European settlers. Kuhlanapo is Pomo for 'water lily people.' The Big Valley Band of Pomo Indians and Lake County Land Trust have created a Memorandum of Understanding for the co-management and stewardship of the Preserve, as well as the development of the Project. Over the next three years, the project partners will create a fully engineered and permitted restoration design that will demonstrate how the hydromodified lower Manning Creek will be reshaped and the adjacent wetland enhanced to restore hydrologic connection and replace non-native vegetation with native vegetation to provide an improved habitat for hitch. A major focus of the project is removing a head cut (waterfall) that is a barrier to hitch migration and restoring channel capacity in Manning Creek to reduce floodplain standing of hitch. During years with modest rainfall, the waterfall is an upstream passage barrier for hitch, who are not skilled jumpers like salmon.

Primary Author: Daniel Deng

Affiliation: Pacific Northwest National Laboratory

Title: Adult Pacific Lamprey Passage and Migration at Bonneville Dam and Lower Columbia RiverAdult Pacific Lamprey Passage and Migration at Bonneville Dam and Lower Columbia River

Key Words: Lamprey, Hydropower, Telemetry, Lower Columbia River

Abstract:

With competing demands of hydropower and the conservation of culturally important species, understanding the effects of passage and migration is essential to balancing energy production with ecological sustainability. Fishways at hydropower dams on the lower Columbia River were originally designed for adult salmonid passage and are less suitable for Pacific lamprey (Entosphenus tridentatus). Since 2013, modifications at Bonneville Dam (BON) have aimed to improve adult lamprey passage. In 2025, Pacific Northwest National Laboratory, under contract with the U.S. Army Corps of Engineers, began assessing the effectiveness of remediation actions by evaluating: 1) passage bottlenecks, 2) post construction lamprey passage improvements, and 3) migration behavior and final fate of adult Pacific lamprey between BON and The Dalles Dam using acoustic telemetry. Data collection and analysis will continue into the fall of 2026; however, preliminary results will be presented at the symposium.From mid-June to mid-August in 2025, 710 adult Pacific lamprey were collected from traps within BON fishways, implanted with high-power acoustic telemetry (AT) tags and passive integrated transponder tags, and released at two locations downstream of the dam. Approximately half of the fish were tagged with AT tags that transmitted every 5 second (four-month battery life), while the remainder of tags transmitted every 15 seconds (one-year battery life). Different pulse rate intervals were implemented to determine both fine scale movements within the fishways, travel times, and fate of fish that may be residing in the BON pool. Detection data from acoustic receivers and PIT arrays in fishways, river reaches, and tributaries were combined to evaluate passage attempts, efficiency, bottlenecks, route-specific efficiency, turn-around and failure rates, fallback, final fates, and survival of lamprey relative to previous studies under original and modified fishway configurations.

Primary Author: Daniel Deng

Affiliation: Pacific Northwest National Laboratory

Title: AI-enabled, Uncertainty-Aware 3D Tracking for Fish Passage Studies

Key Words: Physics-informed neural networks, Fish positioning, Time-of-arrivals, Uncertainty quantification

Abstract:

Accurate three-dimensional fish localization is essential for understanding dam passage, behavior, and habitat use, yet it remains challenging under real-world acoustic conditions. Traditional model-based solvers such as Approximate Maximum Likelihood (AML) rely on pointwise optimization and are highly vulnerable to multipath interference, time-of-arrival (TOA) noise, and synchronization errors. We introduce an AI-based solver built on physics-informed neural networks (PINNs) that performs end-to-end neural trajectory inference from acoustic measurements. The proposed AI-based trajectory PINN (TPINN) models fish motion as a continuous function over time constrained by physical priors, learns directly from noisy TOA observations by minimizing a negative log-likelihood loss, and quantifies predictive uncertainty using AI ensemble learning. We validate TPINN in a season-long field deployment at Little Goose Dam (Washington, USA) using detections from acoustic receivers deployed on dam pier noses.During pre-season controlled testing, we used a remotely operated boat carrying acoustic transmitters, with survey-grade on-boat GPS providing ground truth. TPINN achieves RMS tracking errors of 0.48–0.69 m with 99% tracking efficiency, substantially outperforming AML, which exhibits RMS errors of 2.14–4.79 m and 85% efficiency. During the season, the AI solver was used to track receiver-attached beacons and maintains RMS errors of 0.30–1.66 m with 79–100% efficiency, while AML degrades to 0.33–8.73 m and 0–61% efficiency. Across the full season, 3,587 fish were tagged with acoustic transmitters and released upstream of the dam. TPINN successfully tracked 3,516 fish, generating a total of 2,783,909 position estimates with a median of 264 positions per fish, significantly outperforming the AML solver, which tracked 3,491 fish with 1,527,138 total position estimates and a median of 106 positions per fish. These results demonstrate that physics-informed AI enables robust, high-resolution fish localization at scale, supporting fine-scale ecological monitoring in complex and noisy acoustic environments.

Primary Author: Paul DeVries

Affiliation: Kleinschmidt Associates

Title: Whose Manual is it Anyway?

Key Words: Design Guidelines & Criteria

Abstract:

There is an abundance of manuals with design guidelines and criteria to help practitioners navigate the inherent uncertainty in fish passage design. Various manuals and design guidelines carry a lot of weight, to the extent they are cited as authoritative references in regulatory settings and court cases. But not so fast – as always, caveat emptor… Safety factors aside, this talk provides improvisational examples of excerpts from a suite of manuals where the practitioner might benefit from a less than automatic application…

Primary Author: Andre Dextre

Affiliation: Alameda County Water District

Title: Monitoring Reveals Successful Bidirectional Passage of Anadromous Fishes on Alameda Creek, California

Key Words: Fish passage, bidirectional passage, sonar imagery, PIT antennas

Abstract:

Alameda County Water District (ACWD) constructed two fish passage facilities on Alameda Creek ~16 km upstream of its confluence with San Francisco Bay to restore access for anadromous fish species in a highly managed, urbanized watershed. The project re-established anadromy after an ~50-year interruption caused by migration barriers. The facilities provide bidirectional passage for Central California Coast steelhead (Oncorhynchus mykiss) and other native anadromous species, including Chinook Salmon (O. tshawytscha) and Pacific Lamprey (Entosphenus tridentatus). Passage performance is assessed through an integrated monitoring program that combines video, imaging sonar, passive integrated transponder (PIT) antennas, predator surveys, and direct visual observations, supplemented by citizen science contributions of geo-referenced fish and wildlife observations. Using these methods, ACWD has documented successful O. mykiss, Chinook Salmon, and Pacific Lamprey passage across a range of hydrologic conditions. Streamflow and water quality conditions are continuously monitored during the steelhead migration period (January-May) to verify compliance with passage requirements and to inform real-time operations. Annual results are synthesized within an adaptive management framework to evaluate passage effectiveness, diagnose operational constraints, and guide improvements to facility operations, water management, and monitoring design. This poster highlights key outcomes and remaining challenges of providing reliable bidirectional passage in an urban system, and demonstrates how continuous, multi-method monitoring supports adaptive management of anadromous fish passage.

Primary Author: Jennifer Esteban

Affiliation: Kleinschmidt Associates

Title: Design Process of Fish Passage Projects

Key Words: Design Review Collaboration Engineer

Abstract:

Often times the design of fish passage projects can be a complex process due to various factors that are unique to each site, such as number of fish species to be passed or sorted, quantity of fish to be passed, difficult site access, existing infrastructure competing for space, or need for significant quantity of attraction flow. The various site conditions, design criteria, and engineering requirement require collaboration between fish biologists, various engineering disciplines, site owners, government agencies, and multiple stakeholders. This presentation will highlight what can be expected during the multifaceted design process that is required to develop a fish passage project from concept to construction. The process begins by clearly defining project goals, such as what are the target species that need passage, how the facility will operate, and what success looks like. Early coordination is essential to understand concerns, site constraints, and schedule requirements.Generally, after a feasibility and/or alternative study is conducted, a concept is selected to progress into the design process. The design process is developed in stages, often called 30 percent, 60 percent, 90 percent, and Issued For Construction. Early in the design development, design criteria and constraints are established that are carried throughout the design. At each stage, the design becomes more detailed and the various engineering disciplines, along with biologists, work together to refine layouts, water flows, structures, and equipment. Modeling tools may be used to develop the design. Review and feedback by the client, stakeholders, and agencies, helps improve and direct the course of the project and reduce risks until final design.Permitting and environmental review occur alongside design. Required permits are prepared, submitted, and coordinated with agencies to support compliance with environmental laws and timely approvals.As the project moves toward construction, the design team helps prepare bid documents and supports contractor selection. During construction, engineers provide oversight, answer questions, and help address field conditions to maintain design intent. Regular communication and transparency throughout the process builds trust and supports project outcomes.

Primary Author: Zoe Eyjolfson

Affiliation: Okanagan Nation Alliance

Title: Volitional passage for all indigenous salmonids after 100 years, Okanagan Lake Dam, BC

Key Words: Indigenous-led, natural passage design, passage hydraulics and design, community engagement and education

Abstract:

The Canadian portion of the Okanagan River produces the majority of all Sockeye Salmon in the Columbia Basin (Ogden et al. 2025) and supports Steelhead, Chinook, Rainbow Trout, Kokanee, and 14 other indigenous fish species. Dam construction along the Okanagan River in the early 1900s blocked salmon access to the upper portions of the Okanagan watershed including Skaha and Okanagan lakes, formerly large producers of salmon. Further with channelization in the 1950s, salmon were pushed to the brink of extirpation by the 1990s.Concerned with population declines, the Okanagan Nation Alliance (ONA) initiated salmon reintroduction to blocked areas extending up to Okanagan Lake, the headwaters of the Okanagan River. Over the last 20+ years, the Syilx Nation through hard work and advocacy have led major initiatives including a 12-year study of Sockeye reintroduction into Skaha Lake undertaken by COBTWG (Canadian Okanagan Basin Technical Working Group - a collaborative technical working group of ONA, the Province of B.C. and Fisheries and Oceans Canada (DFO)) and demonstrated its success in rebuilding salmon runs to below Okanagan Lake.The permanent fishway around Okanagan Lake Dam provides volitional passage to the 350 km2 of Okanagan Lake for salmonid rearing and its 14 tributaries, which all have spawning capacity potential. Scientific studies, technical collaboration and indigenous guidance contributed to creating year-round passage which operates at preferred hydraulic conditions for all indigenous species through all migration periods.Built with operational flexibility and climate resiliency, the fishway consists of a naturalized channel incorporating fish attraction flows, an invasive deterrent jump, habitat restoration, a research station and long-term outreach and education components. This collaborative project is a major milestone, bringing the salmon home to their historical waters and the Syilx Nation for the first time in about 100 years.

Primary Author: Frederick Feyrer

Affiliation: U.S. Geological Survey

Title: Stream Connectivity to California's Largest and Oldest Lake: Life History and Passage Needs of Imperiled and Culturally Important Fishes

Key Words: Clear Lake Hitch, native fish, life history, intermittent stream

Abstract:

The majority of California's native migratory fishes face passage problems that challenge conservation. The issue is exemplified by the situation involving native fishes of Clear Lake, California's largest (17,700 ha) and oldest (500,000 ya) natural lake. Clear Lake is in central California approximately 100 km north of San Francisco Bay. Clear Lake is fed by numerous intermittent streams that deliver freshwater seasonally in winter and spring from a 110,000 ha watershed. Native fishes migrate from Clear Lake into streams in spring to spawn and complete their cycle. Clear Lake's iconic flagship species, Clear Lake Hitch, is an endemic fish that has great ecological and cultural importance to the region. Clear Lake Hitch is listed as threatened under the California Endangered Species Act and has been petitioned for listing under the U.S. Endangered Species Act. A variety of impacts have impaired free passage of Clear Lake Hitch between Clear Lake and tributary streams used for spawning. The purpose of this session is to highlight and summarize science and restoration activities being undertaken to promote stream passage to help manage and conserve Clear Lake Hitch, which are expected to also benefit other native fish species. This presentation will frame the session in the context of Clear Lake Hitch life history requirements, which is key for maximizing opportunities to benefit the population.

Primary Author: Dennis Finger

Affiliation: California Department of Water Resources

Title: One Little Notch, One Giant Leap: A Story of Fish Passage Success at the Fremont Weir Adult Fish Passage Facility

Key Words: fish, passage, weir, monitoring

Abstract:

The 1.8-mile-long Fremont Weir, located in Yolo County, is a flood protection feature along the Sacramento River designed to divert floodwaters into the Yolo Bypass and away from the City of Sacramento and other outlying communities. Floodwater flowing into the Yolo Bypass, referred to as "overtopping" of the Fremont Weir, occurs in roughly two out of every three years and can increase attraction of adult migratory fishes such as lamprey, salmonids, and sturgeons into the Bypass. Prior to 2018, the Fremont Weir blocked or significantly delayed adult migratory fish during and after overtopping. To reduce this delay and mortality during overtopping events, the California Department of Water Resources and US Bureau of Reclamation constructed the Fremont Weir Adult Fish Passage (FWAFP) Project. The primary goal of the project was to replace a narrow ladder that offered inadequate passage with a new and larger fish passage structure at the weir. The project also included the removal of two fish passage impediments downstream of the Project. Completed in 2018, the Project improved conditions for fish passage during and following overtopping events in the Yolo Bypass. Following the completion of construction, the Project has operated successfully during and following overtopping events in Water Years 2019, 2023, 2024, 2025, and 2026. During this period, DWR has monitored fish passage efficacy, including via ARIS sonar-imaging observations and acoustic telemetry. In 2019, for instance, DWR used ARIS sonar-imaging to document at least 70 sturgeon and more than 4,000 other adult fish volitionally passing through the structure. This presentation will discuss operational and monitoring successes in recent years and moving into the future.

Primary Author: Eric Fischer

Affiliation: Pacific Northwest National Laboratory

Title: Baseline Evaluation of the North Fork Toutle River Adult Collection Facility

Key Words: Radio Telemetry, Adult Migration, Monitoring and Evaluation

Abstract:

The 1980 eruption of Mount St. Helens in Washington State deposited over 2 billion cubic meters of sediment, volcanic ash, and other debris in the upper North Fork Toutle River (NFTR) valley. To mitigate continuous debris loading to the Toutle, Cowlitz, and Columbia River systems, the U.S. Army Corps of Engineers constructed a Sediment Retention Structure (SRS) soon after the eruption. However, the SRS blocked access to historical spawning grounds of anadromous fish. A Fish Collection Facility (FCF) was subsequently built downstream of the SRS to capture returning adults and transport them to NFTR tributaries upstream of the SRS. A Biological Opinion issued by the National Marine Fisheries Service for continued SRS operation requires upgrading the FCF to current standards to ensure successful adult collection and transport of Endangered Species Act listed coho salmon (Oncorhynchus kisutch) and winter steelhead (O. mykiss). To provide a baseline pre construction assessment, we evaluated (1) fish behavior and distribution in the FCF tailrace, (2) attraction into the fish ladder, and (3) passage through the facility to collection (collection efficiency). Researchers from Pacific Northwest National Laboratory implanted migrating adult and jack coho salmon (fall) and winter steelhead (spring) with radio telemetry (RT) tags. Tagged fish were monitored to characterize their distribution and behavior in the tailrace and to quantify the proportion that entered the ladder and migrated to the FCF presort pool (i.e., indicative of collection). Data analyses are ongoing; results will be presented at the conference. Findings from this study will inform interim FCF operations and provide a baseline for future comparisons with the upgraded facility.

Primary Author: Lina Focht

Affiliation: Federal Waterways Engineering and Research Institute, Germany

Title: From Jet Approach to Passage: Swimming Characteristics of Small Fish Downstream of a Vertical Slot

Key Words: vertical slot fishway, track analysis, swimming velocity, swimming performance

Abstract:

Vertical slot fishways (VSF) are widely used hydraulic structures to restore ecological continuity at dams. However, these structures inherently represent a compromise: the jet velocities at the vertical slots that fish must enter to pass from one pool to the next can exceed the swimming capacities of small or juvenile fish. Yet repeated observations of successful passage indicate that fish may still cope with these conditions - raising the question which swimming characteristics determine success or failure.In this contribution, we investigate swimming characteristics of juvenile roach in the region im-mediately downstream of a vertical slot to distinguish swimming performances that result in either passing or failing to pass the slot. Fish tracks from prototype-scale flume experiments, together with flow fields measured by Acoustic Doppler Velocimetry, enable a trajectory-based analysis of swimming characteristics in the jet flow region. This allows us to move beyond coarse passage metrics and describe where fish enter the jet, how long they remain exposed to the flow, and what swimming speeds they actually deploy when attempting to pass.We show that failure and success can be distinguished by different swimming characteristics. Successful passage is associated with short bursts that exceed swimming velocities reported in the literature swimming derived from swimming tunnel experiments. Overall, passage success is determined primarily by jet entry position, jet exposure duration and burst swimming velocity.The results provide novel insights into the parameters that influence successful passage of small-bodied potamodromous fish at vertical slots. This improves the assessment of vertical slot fish-ways for small cyprinids and provides kinematics-based parameters for individual-based models as well as guidance for fishway design.

Primary Author: Michelle Forsha

Affiliation: California Department of Fish and Wildlife

Title: From Eggs to Adults: Building a Future for Spring-Run Chinook Salmon in the North Yuba River

Key Words: Reintroduction, North Yuba River

Abstract:

Spring-run Chinook salmon (Oncorhynchus tshawytscha) are a federally and state-listed Evolutionarily Significant Unit that historically occupied cold-water habitats throughout the upper Yuba River watershed. Construction of New Bullards Bar Dam eliminated access to these habitats, and the North Yuba River (NYR) has remained unoccupied by anadromous salmon since 1941. In response, the California Department of Fish and Wildlife (CDFW), in collaboration with the Yuba Reintroduction Working Group and numerous partners, initiated a comprehensive reintroduction program to establish a viable, independent population upstream of New Bullards Bar Reservoir.This presentation summarizes the reintroduction findings from the 2024–2026 pilot studies designed to inform long-term implementation. Pilot studies addressed multiple life stages and included instream egg incubation, juvenile collection and transport, aquatic habitat characterization and utilization, parentage-based tagging, and adult monitoring. Approximately 300,000 eyed eggs were hydraulically injected at five locations to evaluate egg-to-outmigrant survival and refine incubation methods. Juvenile outmigration, growth, and habitat use were assessed through rotary screw trap operations and snorkel surveys, while adult feasibility was evaluated using transport, acoustic tagging, and monitoring of movement and spawning activity.Preliminary results confirm successful incubation, juvenile presence, and adult detections within the NYR, demonstrating the potential for supporting critical life-history stages and informing adaptive management of future reintroduction efforts.

Primary Author: George Fowler

Affiliation: Freese and Nichols Inc.

Title: Building Stream Crossings in Texas: A Handbook for Improved Connectivity

Key Words: Connectivity, Restoration, Remediation, Infrastructure

Abstract:

The Building Stream Crossings in Texas: A Handbook for Improved Connectivity provides comprehensive guidance for identifying, assessing, and remedying stream road crossings that impede aquatic and terrestrial organism passage. Drawing on expertise from biologists, engineers, planners, and resource managers, the handbook emphasizes an interdisciplinary framework for improving stream connectivity across Texas's diverse riverscapes. Problematic crossings—such as undersized culverts, perched structures, poorly aligned roadways, and tidal barriers—are shown to disrupt aquatic organism passage, fragment habitats and heighten public safety risks. These impacts are especially significant for native and imperiled aquatic organisms whose life histories depend on unimpeded access to refugia, spawning and recolonization pathways.The handbook outlines practical methodologies, including standardized barrier assessments adapted from national connectivity protocols, to prioritize structures for replacement or remediation. It provides design recommendations—such as stream simulation approaches, natural bottom crossings, and full span structures—that restore ecological function while improving flood resilience, reducing maintenance burdens, and extending infrastructure lifespan. Case studies from across Texas illustrate successful remediation projects that reopened miles of aquatic habitat, enhanced sport fisheries, and strengthened community safety.Recognizing that effective aquatic organism passage restoration requires broad participation, the handbook integrates resources for funding, permitting, and species specific considerations, empowering local governments, landowners, and conservation groups to engage in stream stewardship. It highlights community outreach efforts and the importance of public engagement, noting that many Texans remain unaware of how road stream crossings affect both ecological health and everyday safety. By bridging scientific, engineering, regulatory, and community perspectives, the handbook serves as a practical tool to support statewide efforts to restore aquatic connectivity, protect biodiversity, and build resilient, ecologically functional stream networks.

Primary Author: Mark Gard

Affiliation: California Department of Fish and Wildlife

Title: CDFW fish passage design criteria/guidance and design-review process

Key Words: California, policies, standards

Abstract:

This talk will examine California Department of Fish and Wildlife fish passage design policies and standards, focusing on how regulatory frameworks, design guidelines/criteria, monitoring, and stakeholder coordination shape fish passage implementation. The talk will share California experiences, lessons learned, and opportunities to improve fish passage practice and policy.

Primary Author: Mike Garello

Affiliation: HDR Engineering, Inc.

Title: Studies to Inform Fish Passage above Shasta Dam: Feasibility Appraisal of Chinook Salmon Migration Pathways

Key Words: Sacramento River Winter-run Chinook Salmon, reintroduction, fish passage above high head dams, habitat connectivity

Abstract:

A Consultant Team received funding from the California Department of Fish and Wildlife (CDFW) to review existing information, fill existing physical and biological data gaps, and identify key considerations related to the development and evaluation of volitional and semi-volitional fish passage alternatives for passage around Keswick and Shasta Dams in northern California. Results of the data gaps studies have been incorporated into a parallel study investigating the feasibility of providing volitional passage for fish, particularly Chinook Salmon above Keswick and Shasta dams on the Nomtipom Waywaket (Sacramento River) into the Winnemem Waywaket (McCloud River). Providing passage would allow Chinook Salmon to spawn and rear in historical habitat off the floor of the Central Valley where conditions are more suitable, supporting the long-term resiliency of Central Calley Chinook Salmon populations. A key element of the project included the integration of Winnemem Wintu Indigenous Traditional Ecological Knowledge (ITEK) into the data collection compilation and volitional passage concept development processes. Potential fish passage alternatives are structured around two primary pathways:• Nomtipom Waywaket (Sacramento River) to Keswick and Shasta dams• Tributary Bypass via Cow Creek, Little Cow Creek, and Dry CreekEach pathway presents distinct benefits, risks, constructability challenges, and cost implications that were considered when determining and evaluating fish passage alternatives. This presentation will provide an overview of fish passage alternative development, a summary of factors that influence future alternative advancement, and key findings identified during completion of the appraisal level feasibility study. Tactics and strategies used throughout the alternative development and evaluation process will be highlighted and associated lessons learned acknowledged.

Primary Author: Mike Garello

Affiliation: HDR Engineering, Inc.

Title: Critical Reintroduction Tactics - Improving Cohort Collection Efficiency through Advancement of Juvenile Collection Technologies on the North Yuba River

Key Words: Sacramento River spring-run Chinook Salmon, reintroduction, fish passage above high head dams, juvenile collection, habitat connectivity

Abstract:

Since the 1990s, multiple initiatives have targeted advancement of recovery prospects for spring-run Chinook Salmon and steelhead in the Yuba River watershed. Building on earlier work by the Yuba Salmon Partnership (2014–2018), the Yuba River Working Group (YRWG) was established in 2018 to collaboratively investigate key questions surrounding the reintroduction of spring-run Chinook Salmon into the upper watershed. With funding from the Wildlife Conservation Board (WCB) and Yuba Water Agency (Yuba Water) serving as the project manager, YRWG initiated the Alternative Juvenile Collection Investigation (Study) as part of a phased reintroduction program focused on the North Yuba River above New Bullards Bar Reservoir. This Study's purpose was to determine future facility needs for collecting juvenile spring-run Chinook Salmon as they migrate out of the North Yuba River as part of a long-term reintroduction program. Study results will inform future selection, design, and implementation of juvenile collection systems needed to support successful reintroduction in a highly variable and complex river environment.A consultant team comprised of HDR Engineering, Kleinschmidt Associates, Anchor QEA, and Pacific Netting Products—was retained by Yuba Water to conduct the Study in 2023. This presentation briefly summarizes the overall study process and focuses on key considerations that led to the selection and advancement of preferred collection technologies and configurations. As part of this discussion, use of the Biological Performance Tool and multi-factor evaluation strategy will be emphasized, as well as how these tools were used to scale facility type, size, and complexity to improve collection efficiency while accommodating the unique operating environment of the North Yuba River watershed.

Primary Author: Celia Gaxiola

Affiliation: Department of Wildlife, Fish, and Conservation Biology, University of California, Davis

Title: Assessing the Physiological Response of Larval Green Sturgeon During Passage at a Protective Fish Screen

Key Words: water diversion, fish physiology

Abstract:

Anthropogenic activity, including water diversion from rivers, poses a threat to aquatic biota. To reduce this threat, many water diversion sites include protective fish screens to prevent direct fish entrainment. However, current criteria for the design and operation of screens in the United States are largely based on the swimming performance of salmonids, and may not provide adequate protection for species with weaker swimming capacity, such as sturgeon. While screens can reduce entrainment risk, contact with screens can have lethal or sublethal impacts. To evaluate these impacts, we exposed three size classes (size 1= 28.2mm FL ; size 2= 36.7mm FL; size 3= 46.7mm FL) of larval Green Sturgeon (Acipenser medirostris) to a vertical-slot flat-plate fish screen. Fish were exposed to different combinations of flow by varying the approach (perpendicular to screen) and sweeping (parallel to screen) velocities within current operational guidelines. To quantify sublethal stress and recovery, fish were sampled immediately after the exposure trial, and at four additional timepoints over the subsequent 24hrs. Whole-body cortisol levels indicated sublethal effects varied due to flow conditions and fish size; the smallest size class in the fastest flow condition showed significantly elevated cortisol levels that did not recover after 24hrs. Whole body lactate assays did not indicate anaerobic stress, whereas glucose levels at the fastest flow conditions in size class 3 were elevated, indicating mobilization of energy stores. When combined with information on acute and latent mortalities, this study indicated that the existing salmonid-based screening criteria may not provide sufficient protection for small sturgeon at early developmental stages. Repeated exposures have potential to elicit chronic stress responses, and further work is warranted. By considering physiological indicators in assessment of screen performance, this work offers valuable context and guidance for improving management practices to enhance species conservation in regulated rivers.

Primary Author: Juergen Geist

Affiliation: Technical University of Munich

Title: “Fish-friendly” hydropower – a realistic vision?

Key Words: hydropower, fish passage, ecological impact

Abstract:

“Fish-friendly” hydropower projects target the installation of innovative technologies and the modernization of existing conventional facilities, both aiming at reducing adverse ecological effects on river systems and their biota. We assessed the ecological effects of different conventional and “fish friendly” hydropower solutions in Germany, including their direct impacts on the downstream migrating fish as well as on the habitat quality in adjacent river sections. Our findings characterized the external and internal injury patterns in fish following their downstream passage through various corridors at the hydropower plants, resulting from strikes, shear stress and barotrauma which were sometimes even higher in “fish friendly” installations compared to conventional hydropower. Across all sites, physical barriers with 15 and 20mm bar spacings only protected a small percentage of specimens from turbine entrainment. Habitat quality was mostly impaired as a result of the dam installations, resulting in biological community shifts in upstream sections of the dams. Recently developed innovative hydropower and turbine technologies as well as the use of substitute habitats are now also included in the study, and observation of fish responses and behaviors with sonar-, camera- and tagging-based approaches greatly improve our ability for evidence-informed decision-making on mitigating the adverse effects of hydropower use. This approach also integrates various stakeholder groups and co-production approaches which can serve as a template for implementing mitigation measures in other river systems with hydropower use.

Primary Author: Margaret Giggie

Affiliation: Pacific Northwest National Laboratory

Title: A multiyear post-construction evaluation of Mud Mountain Dam Fish Passage Facility using radio telemetry

Key Words: telemetry, trap and haul, adult Chinook salmon

Abstract:

Dams represent significant barriers to aquatic species, especially migratory fish like salmon. In late 2020, the U.S. Army Corps of Engineers (USACE) completed construction of a new fish passage facility (FPF) on the White River in western Washington State (USA) to aid adult fish passage (trap and haul) upstream of Mud Mountain Dam (MMD). Post-construction evaluations of the FPF were conducted from 2022 through 2025 utilizing radio telemetry (RT). Returning Endangered Species Act (ESA) listed Puget Sound Chinook salmon (Oncorhynchus tshawytscha) were implanted with RT tags and released downstream of the FPF. Aerial and underwater antennas were deployed throughout the study system, encompassing the downstream release site, directly downstream of the FPF (Tailrace), throughout the FPF (Entrance, Ladder, and Presort Pools), at the release location upstream of MMD (Outplant Site), and three sites further upstream. The primary study objectives were to analyze fish behavior and movement, estimate the FPF's collection efficiency, and estimate survival from the FPF to the Outplant Site. Multiple years of data collection were necessary to also evaluate potential effects on Chinook salmon passage from large, biennial pink salmon (O. gorbuscha) runs. Results show an average of 91% of detected fish had their final detection in the Presort Pools, indicating successful collection by the facility. Detections at the Outplant Site (installed for 2024 and 2025) revealed a 100% survival rate from collection in the Presort Pools to release above MMD. Early results also identified potential issues affecting collection efficiency in the Presort Pools, allowing USACE to make facility modifications throughout the study. Collectively, the findings from multiple years of this study contribute to providing safe, timely, and effective passage for ESA-listed adult salmonids.

Primary Author: Elsa Goerig

Affiliation: University of Massachusetts - Amherst

Title: Sprinting performance of longnose sucker: implications for passage at barriers

Key Words: longnose sucker, swimming ability, behavior, fishway design

Abstract:

Natural and anthropogenic riverine features such as cascades, culverts or fishways may impede or delay fish movements, with associated consequences on fitness. The ability to cope with challenging hydraulic conditions is closely related to species' behavior and swimming capacity. Thus, knowledge of maximum swimming capacity and endurance is of primary interest to assess longitudinal connectivity in rivers and design effective fish passage at barriers. Longnose sucker (Catostomus catostomus) is a common sucker species that inhabit cold waters in Russia, Canada and the northern part of the United States, including the Great Lakes basin. Their ecology involves spring spawning migrations that makes them vulnerable to the fragmentation of river habitats. Available data on sprinting performance of longnose sucker is scarce, with previous studies focusing on non-volitional tests in small laboratory environments that could underestimate actual performance. Fish were caught by gillnetting or electrofishing, transported to the USGS Conte Research Laboratory (MA, USA), and tagged with passive integrated transponders. We recorded distance of ascent as well as swim speeds for each attempt. Longnose sucker volitionally entered and swam in a 35 m long flume instrumented with RFID antennas, under flow velocities ranging from 0.50 to 3.0 m s-1. The relationship between swim speed and fatigue time for prolonged and sprint swimming modes was quantified, as well as maximal distance of ascent in the flume. Using a time-to-event analytical framework, we assessed the effect of flow velocity, water temperature and diel period on the endurance and performance of longnose sucker. Our results suggest that longnose sucker swimming performance is reduced when cross-sectional flow velocity exceeds 2.0 m s-1. This project is part of a larger effort involving other freshwater species, with implications for prediction of fish passage at barriers and fishway design.

Primary Author: Geoffrey Goll

Affiliation: Princeton Hydro

Title: Translating Science, Restoring Connectivity: International Partnership for the Oeiras River, Portugal

Key Words: International collaboration, river restoration, Portugal

Abstract:

This presentation summarizes a collaborative effort between Princeton Hydro in the United States and the World Wildlife Fund of Portugal, funded by the European Open Rivers Programme, to advance river restoration and barrier removal along the Oeiras River, an seasonally intermittent Mediterranean type river in the Guadiana River basin in the Alentejo region. The work focused on the engineering design and ecological assessment for the removal of the Horta do Fialho weir and the feasibility/concept-level evaluation of eight additional structures that restrict aquatic organism passage, disrupt geomorphic processes, and impede the movement of native fish and freshwater mussel species. The project required a balanced approach, recognizing the ecological benefits of barrier removal while working within constraints that included landowner/social concerns, local reliance on existing crossings, and cultural attachment to long-standing weirs.A key component of this work involved the bilingual nature of technical communication. Engineering documents were originally prepared in English and then converted into Portuguese for permitting, review, and eventual construction. To ensure technical accuracy and adherence to local engineering conventions, the translation process relied on a combination of AI-based conversion tools, professional human translators, and iterative review with WWF Portugal. This approach proved essential for aligning terminology, design standards, and regulatory expectations with European and Portuguese engineering standards for construction.Field assessments, geomorphic observations, hydrologic review, and stakeholder discussions collectively informed a set of practical solutions ranging from full barrier removal to structural retrofits where removal was not feasible. These recommendations reflect conditions observed on the ground, flow regime characteristics, sediment behavior, and the broader objective of restoring more than 140 kilometers of longitudinal connectivity.Overall, this work demonstrates that when international teams coordinate closely, across languages, time zones, and regulatory frameworks, technically sound, locally compatible, and ecologically meaningful restoration solutions can be achieved.

Primary Author: Geoffrey Goll

Affiliation: Princeton Hydro

Title: Legacy Run-of-River Dams, Modern Risks: Evaluating Flood Mitigation to Supplement Ecological Restoration Goals from Barrier Removal

Key Words: run-of-river, flood hazard, resilience, dam removal

Abstract:

As implementation costs for river-restoration projects continue to rise, dam removal and fish-passage initiatives are increasingly evaluated not only for their ecological benefits but also for their broader community value. While ecological improvements have long driven funding decisions, additional co-benefits, such as increased community resilience, avoided maintenance of obsolete infrastructure, and reduced natural hazard insurance costs, are becoming critical components to justify projects.This presentation examines run-of-river dams that remain common throughout the northeastern United States, where aging structures continue to influence local flooding and restrict aquatic connectivity. Using the Upper and Lower E.R. Collins Dams in New Jersey, located within 1,500 feet of the Delaware River, as a case study, we outline a practical, transferable methodology for quantifying flood-hazard reduction as a measurable benefit of dam removal.The analysis integrates FEMA flood profiles, LiDAR derived topography, and hydrologic and hydraulic modeling to compare pre- and post-removal conditions. Results indicate meaningful reductions in upstream flood elevations during major flood events, offering meaningful relief for municipalities burdened by repetitive-loss and severe repetitive-loss properties.In addition to flood mitigation, removal of these legacy structures improves passage for migratory species, including American shad, river herring, sea lamprey, and American eel, enhances macroinvertebrate diversity, and supports water-quality improvements. Communities further benefit through reduced dam owner liabilities, eliminated infrastructure maintenance costs, improved public safety, and expanded recreational opportunities that can contribute to local revitalization.The presentation concludes with a step-wise framework for practitioners using FEMA data to assess flood extents and hydraulic modeling, and evaluating municipal-level gains such as reduced flood insurance premiums and long-term resilience improvements. By incorporating flood hazard reduction into feasibility studies, practitioners can more effectively demonstrate the holistic value of dam removal, strengthening support for projects that advance both ecological restoration and community resilience.

Primary Author: Justin Gragg

Affiliation: Environmental Science Associates

Title: Tisdale Weir Rehabilitation and Fish Passage Project

Key Words: Tisdale Weir, notch, salmon, sturgeon

Abstract:

The Tisdale Weir, completed in 1932, is a critical State-owned flood management facility located on the east (left) bank of the Sacramento River about 56 miles north of the City of Sacramento. The weir is one of five major overflow weirs in the Sacramento River Flood Control Project (SRFCP) and is generally the first to start spilling and the last to stop. Though successful in reducing frequent inundation of developed areas, the flood weir and bypass system comprising the SRFCP was generally designed and built prior to enactment of existing laws and regulations requiring fish passage. Prior to initiation of the Tisdale Weir Rehabilitation and Fish Passage Project (Project), Tisdale Weir needed structural rehabilitation to extend its design life and, during certain flow conditions, prevented up-migrating salmon and sturgeon from returning to the Sacramento River as flood and weir flows receded.In 2025, the California Department of Water Resources began construction of the multi-benefit Project, which includes both necessary structural repairs to the weir and installation of fish passage facilities to reduce stranding of adult salmon and sturgeon and improve passage from the Tisdale Bypass to the Sacramento River. The fish passage facilities consist of a reconstructed energy dissipation and fish collection basin on the downstream side of the weir, installation of a notch and operable gates within the weir, and construction of a channel connecting the notch to the Sacramento River.This presentation will give an overview and explore key aspects of Project planning, design, and ongoing implementation/construction activities, including how historic and contemporary hydrologic and geomorphic processes were considered in Project design, bypass land use compatibility, implementation challenges, planned gate operation, and monitoring and adaptive management. Further, we will discuss potential ancillary benefits to juvenile fish and other related operations considerations.

Primary Author: Elizabeth Greene

Affiliation: Anchor QEA, Inc.

Title: Studies to Inform Fish Passage Evaluation above Shasta Dam: Results and Lessons Learned

Key Words: Sacramento River Winter-run Chinook Salmon, reintroduction, fish passage above high head dams, habitat connectivity

Abstract:

A Consultant Team received funding from the California Department of Fish and Wildlife (CDFW) to implement studies to gather data, compile information, and identify data gaps related to physical and biological conditions to begin to fill key data gaps and support the development and evaluation of volitional and semi-volitional fish passage alternatives for passage around Keswick and Shasta Dams. Results of the data gaps studies have been incorporated into a parallel study investigating the feasibility of providing volitional passage for fish, particularly Chinook Salmon above Keswick and Shasta dams on the Nomtipom Waywaket (Sacramento River) into the Winnemem Waywaket (McCloud River) in northern California. Providing passage would allow Chinook Salmon to spawn and rear in historical habitat off the floor of the Central Valley where conditions are more suitable. A key element of the project included the integration of Winnemem Wintu Indigenous Traditional Ecological Knowledge (ITEK) into the data collection and compilation and volitional passage design processes. The physical and biological data were collected and compiled for two potential pathways to allow Chinook Salmon to reach the Winnemem Waywaket. The fish passage alternatives are structured around these two pathways: Nomtipom Waywaket (Sacramento River) to Keswick and Shasta dams; Tributary Bypass via Cow Creek, Little Cow Creek, and Dry Creek. Each pathway presents distinct physical and biological conditions that must be considered when determining and evaluating fish passage alternatives. This presentation will provide a summary of these considerations and discuss key lessons learned during project implementation.

Primary Author: Robert Gubernick

Affiliation: Northwoods Resources LLC

Title: Opposition to Adoption: the USFS Stream Simulation Methodology at Road-Stream Crossings

Key Words: stream simulation, policy, design standards

Abstract:

Because of its unique role of managing public lands and waters, along with a vast transportation system, the US Forest Service developed its own design methodology for road-stream crossings over 20 years ago. Stream Simulation, the agency's formal methodology, was designed to ensure unimpeded aquatic organism passage. as well as enhanced flood resilience of the transportation system. The concepts of Stream Simulation were developed in the Pacific Northwest in response to endangered species listings of salmon and steelhead, but the methodology has since gained traction across the United States. Moving the 'state of the science' away from traditional hydraulic designs and toward a more geomorphic-based approach has been a turbulent path, both within the Forest Service and with partners like DOT's, counties, and other federal agencies. We will examine how our policy and design methodologies have evolved over the last two decades, primarily as a way to 1) promote a methodology that is not viewed as overly complicated or expensive, 2) Promote the flood resiliency aspect in addition to aquatic organism passage, and 3) ensure that work on National Forest lands adhere to these standards, whether the work is being done by USFS employees, cooperating federal partners, or private contractors

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Primary Author: Katie Guetz

Affiliation: American Rivers

Title: From Data to Decisions: Strategic Dam Removal for Fish Passage and River Restoration in the Pacific Northwest

Key Words: Dam removal, restoration

Abstract:

The Whidbey Basin Dam Removal Pipeline Project is a watershed-scale effort to move beyond opportunistic dam removal toward a strategic, transparent, and community-informed approach to restoring fish passage and river function. The project seeks to identify dam removal opportunities that deliver meaningful ecological results while also accounting for social, cultural, and economic considerations at the local level. American Rivers analyzed and compiled data for approximately 264 dams in the Whidbey Basin, north and east of Seattle Washington, in partnership with the National Aquatic Connectivity Collaborative, using the National Aquatic Barriers Inventory (NABI) as the primary data set. These data were synthesized into a decision-support framework that allows practitioners to compare fish passage and watershed benefits against real-world implementation constraints across the entire basin, rather than on a project-by-project basis. The framework is the Dam Removal Opportunity Matrix developed by American Rivers' Northwest Region dam removal team. The Opportunity Matrix evaluates dams using a consistent set of benefit and constraint metrics to highlight where removal is most likely to produce meaningful outcomes. Rather than producing a single ranked list, the Matrix is designed to support flexible, scenario-based decision-making by helping users explore tradeoffs and identify projects with strong potential for beneficial impact. This presentation will introduce the structure and logic of the Opportunity Matrix, describe how it was built from NABI data, and present initial results from application to the Whidbey Basin Project. We will also discuss how this approach supports coordination among agencies, Tribes, and local partners by providing a shared, transparent basis for prioritization. We will conclude with and how the framework can be applied in other watersheds to advance fish passage, restoration, and dam removal planning across the Pacific Northwest and beyond.

Primary Author: Blake Hamilton

Affiliation: Kleinschmidt Associates

Title: Entrainment and survival of a critically depressed bull trout population

Key Words: entrainment, salmonid, telemetry

Abstract:

Bull trout are a char species listed as threatened in the coterminous United States under the Endangered Species Act. Keechelus Reservoir, in the Yakima River Basin of south-central Washington State, hosts a single, critically depressed population of bull trout. Once a natural lake, Keechelus Reservoir was impounded in 1917 to provide water storage for downstream uses. The dam was constructed without fish passage, subsequently extirpating anadromous salmonid populations, and isolating the remaining bull trout population from others in the Yakima River Basin. We double tagged 39 bull trout with Innovasea V9TP transmitters and PIT tags to understand bull trout movement and track entrainment through the dam, which is beginning to be understood as a major threat to the maintenance of viable populations. Of the 39 fish tagged in July of 2024, five had been entrained by the end of October 2024. While this study is ongoing, we've used preliminary data to estimate entrainment risk and mortality of tagged bull trout using a Bayesian multi-state mark recapture and produced utilization distributions to outline core areas in the reservoir. We intend to identify correlates of entrainment risk with hopes that this knowledge may offer viable mitigation options to water managers.

Primary Author: Chris Hammersmark

Affiliation: Verdantas Eco Engineering

Title: Restoring Habitat and Connectivity in a Heavily Degraded River – The Hallwood Floodplain and Side Channel Restoration Project

Key Words: Lateral connectivity, salmonids, river restoration, floodplain restoration

Abstract:

Gold Rush era anthropogenic actions in the Yuba River Watershed altered geomorphic and hydraulic conditions and available habitat for rearing juvenile salmonids in the lower Yuba River. The Hallwood Side Channel and Floodplain Restoration Project was designed to enhance ecosystem processes for juvenile rearing fall- and spring-run Chinook salmon and Central Valley steelhead by restoring floodplain and other off channel areas, enhancing lateral connectivity to those areas, as well as restoring longitudinal connectivity to a historic side channel. Implementation was completed in fall 2023 through a Public-Private Partnership that was supported by interested parties at federal, state and local levels, and leveraged relationships with aggregate mining landowners facilitating innovative, economical approaches to habitat enhancement, passage improvement and flood risk reduction. The design increased inundation frequency and duration in perennially and seasonally inundated side channels, removing unnatural constraints between channel and floodplain areas and reducing predator habitat. Over five years of construction, 157-acres of juvenile salmonid rearing habitat was created or enhanced, including two miles of perennial channels and alcoves and six miles of seasonal side channels. The habitat enhancement actions also led to a 3 ft reduction in the 100-yr water surface elevation in the project reach. This presentation will provide an overview of the project design and implementation as well as highlight key monitoring results.

Primary Author: Kelly Hannan

Affiliation: University of California, Davis

Title: Endurance Swimming to Inform Risk of Entrainment for Native California Fishes

Key Words: swimming, entrainment risk, fish

Abstract:

The San Francisco–San Joaquin watershed is one of the most heavily managed aquatic systems in California, where thousands of water diversions, annual dredging operations, and large-scale pumping facilities have the potential to impact fish populations. These anthropogenic activities can lead to the entrainment of sensitive native species, including juvenile Green and White Sturgeon (Acipenser medirostris, A. transmontanus), Chinook Salmon (Oncorhynchus tshawytscha), and Delta Smelt (Hypomesus transpacificus). Anadromous juvenile fishes during outmigration are more likely to encounter multiple structures further increasing their likelihood of entrainment.To better understand species and life stage vulnerability to entrainment, we conducted fixed-velocity endurance swimming trials across multiple life stages. From these trials, we developed endurance curves describing time-to-fatigue (min) data across test velocities. We then integrated these data with observed behaviors (e.g., rheotaxis, benthic orientation) to estimate entrainment risk across a range of intake flow velocities.Results indicate that Chinook Salmon of comparable size to sturgeon and Delta Smelt demonstrate stronger swimming abilities overall. Operational guidelines have historically focused on salmonids, however these differences highlight the importance of species- and size-specific thresholds when developing operational guidance for flow management.By linking laboratory-derived swimming performance data with hydraulic conditions in the field, this work provides a quantitative framework for estimating entrainment risk. These findings can inform management decisions regarding flow rates at water diversions, pumping facilities, and dredging operations to minimize entrainment of threatened native fishes and support their conservation.

Primary Author: Darryl Hayes

Affiliation: Intake Screens, Inc.

Title: Water Intakes in Post-Dam-Removal Rivers: Design Challenges and Adaptive Solutions

Key Words: Dam removal, intake design, sediment dynamics, fish passage and protection

Abstract:

Dam removal is increasingly used worldwide as a strategy to restore river continuity, sediment transport, and aquatic habitat. While these projects can provide substantial ecological benefits, they also create new hydraulic and geomorphic conditions that affect the performance and reliability of existing and planned water diversions and intakes.This presentation examines how post-dam-removal environments influence intake design and operation, with particular focus on shallow-water conditions, dynamic sediment movement, and the use of engineered riffles or grade-control features to establish stable channel elevations. Changes in water depth, approach velocities, debris transport, and sediment deposition can challenge traditional diversion and screening approaches, especially where infrastructure must function across a wide range of flows.The discussion centers on intake and screening concepts suited to these evolving conditions, including flexible intake elevations, sediment-tolerant screening configurations, shallow-submergence strategies, and the establishment of hard points to support long-term infrastructure reliability while maintaining fish passage and protection objectives. By emphasizing design principles rather than site-specific solutions, the presentation provides a framework applicable to post-dam-removal rivers across diverse hydrologic and regulatory settings.

Primary Author: Michael Hellmair

Affiliation: FISHBIO

Title: Automated Monitoring and Selective Passage: Excluding Invasive Salmon Using AI Species Recognition

Key Words: AI species recognition; selective passage; monitoring; invasive species

Abstract:

The increasing abundance and rapid range expansion of non-native pink salmon in the North Atlantic has raised significant concern about their effects on fragile riverine ecosystems, cherished native species, and the economically important aquaculture industry in Norway and beyond. Local and government engagement to prevent pink salmon from spawning is high, and trapping the fish as they return to freshwater to spawn has been effective in removing unwanted pinks, often numbering in the tens of thousands. Trapping, however, involves labor-intensive manual sorting to release native species, which can result in stress, injury, or even death. To minimize the impact of pink salmon suppression on native species and to make the process more streamlined and sustainable, we developed an automated platform that rapidly identifies passing fish using AI, then selectively routes native species back into the river and diverts invasives into a trap box for removal. System testing in a large river in northern Norway, where the platform was integrated with a resistance board weir, the platform achieved a trapping efficiency of over 97% for invasive pink salmon, while reducing handling of native species by 94%. We estimate that, with an observed transit time of as little as ten seconds, our system can identify and sort several thousand fish per day, greatly reducing the need for manual sorting and simultaneously improving the welfare of native fishes. Remote connectivity permits real-time verification of functionality, while user-defined thresholds automatically notify operators when target numbers of trapped fish are reached, and fish passage data provides information on migration characteristics, species composition and size distribution. This novel technology could be applied to numerous management and research challenges, including selective passage of native or natural-origin fish and targeted trapping for propagation or research.

Primary Author: Kassie Henley

Affiliation: California Department of Water Resources

Title: North Fork Feather River Reintroduction Feasibility Study: Chinook Salmon Behavior and Juvenile Capture

Key Words: spring-run Chinook Salmon, egg incubation, juvenile capture, trap efficiency

Abstract:

Given the current state of Spring-Run Chinook salmon in California, the need has increased to explore and potentially implement new tools to provide access to historic high-quality habitat high above large rim dams. Lessons learned from the PNW demonstrate the significant challenge of making reintroduction “successful” and cost-effective. Juvenile Chinook salmon often emigrate to the estuary and ocean during peak winter or spring flows. “Trap and haul” programs that aim to return salmon to historic spawning grounds far above large dams can face challenging conditions for trapping emigrating juveniles, primarily unregulated high flows and debris loads that interfere with juvenile capture. As part of the study to determine the feasibility of reintroducing Spring-run Chinook salmon to historic habitat, an evaluation of juvenile behavior and capture efficiency was implemented in the North Fork Feather River Above Lake Almanor. This presentation summarizes the study’s effort to (1) determine the feasibility of deploying eggs into the system to inform juvenile emergence timing, behavior, and emigration timing, (2) test and improve capture efficiency of out-migrating juveniles, and (3) document limitations to a trap and haul program of Chinook salmon. The results demonstrate a unique opportunity that warrants further investigation.

Primary Author: Megan Hill

Affiliation: Portland General Electric

Title: Optimizing Fish Passage Facilities: Lessons from the Clackamas and Deschutes Rivers

Key Words: adaptive management, hydropower, Oregon

Abstract:

Portland General Electric (PGE) operates juvenile and adult fish passage facilities at its hydroelectric projects on the Clackamas and Deschutes rivers in Oregon. These facilities support the passage of salmon, steelhead, bull trout, lamprey, and other native migratory fishes. Collectively, PGE's fish passage infrastructure includes a juvenile fish pipeline, floating surface collectors, a hands-free adult sorting facility, spillway exclusion nets, fish ladders, and a Buckley-style fish trap. These facilities were constructed or refurbished following hydroelectric project relicensing in 2006 (Deschutes) and 2010 (Clackamas). After construction and upgrades, PGE conducts extensive testing and verification studies to evaluate facility performance and identify the need for post-construction modifications. In this presentation, we share key lessons learned from more than a decade of adaptive management focused on optimizing fish passage facility performance in Oregon.

Primary Author: Lisa Hollingsworth-Segedy

Affiliation: American Rivers

Title: Synergizing community and ecosystem benefits through dam removal: the Universal Traveler approach

Key Words: dam removal, river restoration, revitalization

Abstract:

The modern era of dam removal commenced in 1999 with the removal of Edwards Dam on the Kennebec River. The appeal of this project was rooted in eliminating obsolete infrastructure, decreasing liability, and reconnecting a river for migratory fishes' access to aquatic habitat. Early practice expansion focused on more of the same: increase the quantities of dams removed, the miles of aquatic habitat reconnected, and fish species benefitted. As practitioners sought support for more numerous and more complex projects, we crossed into Universal Traveler territory, seizing the opportunity "to look at one thing and see many things." Depending on any particular dam's context in built and natural environments, it's potential removal may offer benefits beyond ecological lift, including public safety, improved recreation access, equitable recreation access, expanded water-based experiences, entrepreneurship opportunities, flood resiliency, viewshed improvement, bolstered community character and quality of life, eco-tourism, workforce development, and economic competitiveness. American Rivers is intentionally working to mature the dam removal community of practice by engaging new partners that bring a broader range of expertise and resources such as community planners and designers, hazard mitigation specialists, economists, historians, artists, keepers of cultural traditions, and entrepreneurs to help identify and deliver more benefits of free-flowing rivers: 1) promoting both ecological and community benefits to attract wider support for dam removal through issues that motivate a wider audience, 2) prioritizing dam removals in watersheds where significant previous conservation investment has already catalyzed ecological lift, 3) reducing the potential of loss of human life by prioritizing removal of obsolete lowhead dams on water trails, and 4) Developing river-friendly water supplies to continue meeting drinking water needs in free-flowing conditions. This talk will highlight the strategies and decision-points that have synergized the community and ecological benefits of dam removals and suggest options for emerging projects.

Primary Author: Kelly Hughes

Affiliation: ATS Environmental

Title: Fish Friendly Tide Gates Made Simple

Key Words: Fish Friendly Tide Gate

Abstract:

Various studies over the years have highlight the importance of providing fish passage at tide gates. Significant reaches of waterway and vast areas of aquatic habitat can be reconnected by modifying or replacing tide gates. Some of the typical solutions offered are extremely expensive and/or unreliable. This presentation describes a different approach, where altering the geometry of a common tide gate design enables both fish passage and flood protection security at an affordable cost.

Primary Author: Martin Hunt

Affiliation: Manitoba Hydro

Title: Final Design, Optimization, and Construction of the Goose Creek Fishway and Bridge Rehabilitation Project

Key Words: Fish passage, hydraulic modelling, fishway design, northern rivers

Abstract:

The Goose Creek fishway and bridge rehabilitation represents the culmination of more than two decades of operational experience, monitoring, and design evolution at the Churchill Weir. Building on lessons learned from repeated ice and flood damage, the recent final design incorporates substantial hydraulic, structural, and ecological optimizations intended to deliver robust fish passage performance while improving long term maintainability.The optimized fishway design employs a three-ramp configuration with intermediate resting pools, a reduced slope, and an offset grid of embedded boulder elements to generate stable low velocity pathways and skimming flow conditions that support upstream movement of weak swimming species such as Northern Pike. Relocating the primary ramp downstream of the bridge improved hydraulic control, inspection access, and monitoring capability, while minimizing the formation of hydraulic jumps observed in the original configuration. The project also included major inlet modifications including lowering the bridge invert and reducing wingwall angles to improve hydraulic conditions and mitigate ice related structural risks.A key design decision involved the removal of the winter supply culverts originally proposed to maintain overwinter connectivity within the enhancement reach. Hydraulic modelling and updated flow analyses demonstrated that the rehabilitated fishway and the naturalized west side flow paths would provide sufficient winter connectivity under the anticipated operating range, eliminating the operational and maintenance challenges associated with buried culverts.Enhancement reach connectivity was further improved through targeted dredging, dyke repairs, and profile modifications at the Goose Creek outflow, informed by detailed geotechnical investigations and numerical hydraulic modelling. Construction required extensive ice season access planning, staged sequencing, and adaptive field modifications to address riverbed variability and weather driven constraints.This presentation will summarize the final design, optimization process, construction challenges, and key lessons learned to inform future fish passage rehabilitation projects in northern and ice affected environments.

Primary Author: Sandra Jacobson

Affiliation: California Trout

Title: Restoring Fish Passage for Endangered Southern Steelhead in Southern California: Challenges and Opportunities

Key Words: Fish passage 30x30

Abstract:

Southern California is the prism through which aquatic endangered species protection and habitat connectivity are interwoven with water supply, transportation infrastructure, public safety, flood control, urban development, tribal cultural history, coastal dynamics and watershed health. The Interstate-5/Metrolink fish passage project on Trabuco Creek in Orange County has all of these wrapped up into a final design package to protect endangered Southern steelhead from extinction. This project is poised for construction in 2026 to restore historical migration of steelhead through 12 miles of stream to reach prime spawning and rearing habitat 30 miles inland in the Santa Ana mountains. The project is regionally unique by integrating advanced hydraulic engineering of long nature-like fishway ramps into major transportation infrastructure. This watershed-scale project restores functional anadromy to Southern steelhead and leverages removal of >80 check dams in upper Trabuco Creek by the US Forest Service that maximizes local aquatic species mobility in response to fire and drought. Given the abrupt changes in climatic events and the time-sensitive need to achieve 30x30 goals, a parallel approach will also be presented that integrates meadow and forest restoration efforts into quantifiable carbon, water, species and potential energy benefits on a landscape scale in the Sierra Nevada.

Primary Author: Andrea James

Affiliation: Chickaloon Village Traditional Council

Title: From Knowledge to Action: Tribal Fish Passage and Habitat Restoration in Alaska

Key Words: Fish passage, salmon conservation, Tribal stewardship, restoration

Abstract:

Chickaloon Native Village is an Ahtna Dene Tribe that has stewarded the Matanuska Watershed of Southcentral Alaska since time immemorial. Fish, and specifically salmon, are foundational sources of food and cultural well-being for Chickaloon Native Village and many peoples in Alaska. Salmon resilience depends on many factors including habitat availability, quality, and connectivity, all of which have been increasingly compromised by fish passage barriers, wetland loss, and expanding infrastructure within salmon habitats. These stressors have contributed to declining salmon populations across the state. Through both Western science and traditional ecological knowledge, Chickaloon Native Village works to restore fish habitats and promote the conservation of salmon throughout the Tribe's traditional territory. Chickaloon Native Village was awarded Bipartisan Infrastructure Law (BIL) funding to create a Tribal Fish Passage Program and restore fish habitats through the National Oceanic and Atmospheric Administration (NOAA) Restoration Center's Restoring Tribal Priority Fish Passage through Barrier Removal Program and the US Fish and Wildlife Service National Fish Passage Program. The Chickaloon Native Village Tribal Fish Passage Program was created in 2023 and increases knowledge and actions for aquatic organism passage restorations. The program expands Tribal capacity to implement fish passage restoration projects in the state of Alaska by providing free, hands-on, training opportunities in fish passage and habitat restoration for Tribal entities. In addition, the Tribal Fish Passage Program implements fish passage barrier removal and stream restoration projects in the Tribe's traditional territory. This presentation highlights fish passage barrier removal efforts led by Chickaloon Native Village, demonstrating how Tribal leadership, coordination with partners, and capacity-building are essential to restoring habitat connectivity and sustaining salmon populations in the Matanuska Watershed and beyond.

Primary Author: Feng Jingjie

Affiliation: Sichuan University

Title: Dissipation Characteristics of Supersaturated Total Dissolved Gas in High-Altitude Rivers

Key Words: Total dissolved gas, mitigation, fish mortality, high-altitude river

Abstract:

Total dissolved gas (TDG) supersaturation is almost an inherent phenomenon accompanying dam discharge, which may induce gas bubble disease (GBD) in fish and even large-scale fish mortality. With the planning of hydropower projects to high-altitude areas, dam discharge of the same design under low atmospheric pressure conditions will result in a higher TDG saturation level. Coupled with the sensitive and fragile aquatic ecosystems on the plateaus, the ecological risks arising from dam discharge have garnered growing attention. Three experimental sites at different altitudes (3273 m, 1452 m, 493 m) were selected to construct distinct natural atmospheric pressure environments. By using supersaturated water bodies from the natural discharge of hydropower stations and those artificially prepared in the laboratory, experiments on the dissipation of supersaturated TDG at different water temperatures were conducted under various atmospheric pressure conditions. It is shown that the supersaturated TDG dissipation coefficient increases with the rise in water temperature, and it also becomes larger as the altitude increases or the atmospheric pressure decreases. Firstly, a quantitative relationship between the supersaturated TDG dissipation coefficient and water temperature was established. On the basis of this relationship, the influence of water temperature was eliminated, and then the effect of atmospheric pressure on the TDG dissipation coefficient was derived, thereby obtaining a comprehensive correction relationship for the impacts of water temperature and atmospheric pressure on the dissipation coefficient. The model was verified by using prototype observation data. A specific high-altitude river reach was selected to compare and quantify the improvement effect of considering the impacts of atmospheric pressure and water temperature on the prediction accuracy of supersaturated TDG in high-altitude rivers. The research findings are of great significance for the ecological risk control of dam discharge and aquatic ecological protection in high-altitude rivers.

Primary Author: Wendy Katagi

Affiliation: McMillen

Title: LA River Connecting Fish and Our Communities Aligned with 30x30 Movement

Key Words: Fish Passage, 30x30, connectivity

Abstract:

This talk is linked to the selected 30x30 fish passage session block and highlights the importance of steelhead fish passage reconnecting the headwaters to ocean migration for endangered steelhead moving into implementation before LA28 Olympics. This program is a catalyst for the LA River restoration movement that balances multiple community and science driven themes toward watershed and community resilience by implementing key initiatives in LA Biodiversity, 30x30 conservation, water resource portfolio needs, access to nature, tribal stewardship, and ties to global 30x30 movement through the transformation of one of the most urbanized rivers for the return of steelhead trout.

Primary Author: Hazel King

Affiliation: Inland Fisheries Ireland

Title: Ireland's National Barrier Mitigation Programme – alleviating hydromorphological pressures and facilitating cross border fish passage in Irish river catchments

Key Words: Fish-passage, barrier-mitigation, cross-border

Abstract:

Inland Fisheries Ireland (IFI) is the state agency responsible for the conservation, protection, and management of inland fisheries in Ireland. The Barrier Mitigation Division of IFI was established in 2024 to lead the delivery of the National Barrier Mitigation Programme (NBMP). This was in response to objectives established in the National Water Action Plan which stated that "IFI will establish a restoration programme to mitigate the negative impact of past construction in or near rivers". The NBMP is a $150 million 4 year project recently established by central government in Ireland. The scheme seeks to improve lateral connectivity in Irish Rivers with the removal of barriers to fish passage. The programme represents a key Government initiative in the implementation of the EU's Water Framework Directive and Nature Restoration Law 2024. Fish movements and migrations can be affected by different man-made structures in rivers. These may include small structures such as bridge floors, culverts, sluices, to larger structures such as weirs and dams. The Reelin River barrier mitigation project, in County Donegal, showcases the potential for cross-border co-operation with fisheries agencies in non-member states. The project to remove a ford river crossing opened up several miles of additional high quality gravel spawning beds upstream. The alleviation of hydromorphological pressures associated with the barrier removal is clear from the drone imagery.For the first time a national inventory of barriers has been created in Ireland and to date there are over 5,000 barriers identified in Irish watercourses. The IFI open data portal can be used by community groups to identify potential fish barriers in their locality. The programme is underpinned by a bespoke Communications and Stakeholder engagement plan. The value proposition is as follows: 'Restoring river connectivity for the benefit of aquatic biodiversity, through an evidence-based, policy-led, and stakeholder-focused approach'.

Primary Author: Brian Kelder

Affiliation: NOAA Restoration Center

Title: Restoring fish and community connection in a coastal Massachusetts River: Lessons learned from a partnership-driven project

Key Words: Dam Removal, Fishway, River Herring, Public Engagement

Abstract:

For well over a century an industrial property on the Monatiquot River in Braintree, Massachusetts was a dead end for migratory fish. The site's two dams and reconfigured river channel blocked access for species like river herring and hindered passage of American eel. The derelict urban industrial site also offered no public river access though there wasn't much to see. In 2008 the Massachusetts Division of Marine Fisheries began a feasibility study that identified the site as a priority for fish passage restoration due to strong annual river herring returns downstream of the site and ample historic spawning areas upstream. In 2023, the Town and the private landowner, with the support of a broad coalition of state, federal and local partners finally broke ground on the fish passage phase of the project. The restoration included the full removal of two dams, a fish ladder to bypass an over steepened section of stream, and public access through the former impoundment. In the spring of 2025, the first run of river herring swam through the site, accessing 36 miles and over 180 acres that had been blocked for two centuries. This also marked the opening of the new park that provides the public with a connection to a resource that had been hidden for decades. The former defunct industrial site is slated for redevelopment providing a win for the landowner and the community. This project provides an example of the potential for fish passage restoration projects to have multiple benefits. Through project development and implementation, the public-private partnership learned many lessons that can inform future projects in Massachusetts and beyond.

Primary Author: Tyler Keys

Affiliation: California Department of Water Resources

Title: Lessons Learned from Implementing a Head-of-Reservoir and In-River Juvenile Salmonid Collection System on the McCloud Arm of Shasta Reservoir

Key Words: JSCS, Winter-Run Chinook Salmon

Abstract:

DWR deployed the Juvenile Salmonid Collection System (JSCS) on the Winnemem Waywaket (McCloud River) annually 2022-2025, in partnership with CDFW, NOAA Fisheries, and the Winnemem Wintu Tribe, to collect outmigrating juvenile winter-run Chinook Salmon in a feasibility study assessing salmon reintroduction potential above Shasta Dam. As part of the winter-run Chinook salmon reintroduction effort on the Winnemem Waywaket (McCloud River), a head-of-reservoir collection system for out-migrating juvenile salmon was deployed at the transition between the Winnemem Waywaket and Shasta Reservoir during the fall over the past four years. The goal of this study was to safely and efficiently test and develop new juvenile salmon collection methods at a range of flows. The field team released the collected juvenile salmon downstream of Shasta and Keswick dams to continue their outmigration down the Sacramento River. Over the course of the pilot study, the field team deployed the JSCS at seven locations across the river-reservoir interface between Dekkas Rock and the McCloud Bridge. The study tested two different capture methods: a net-based trap in head-of-reservoir conditions and a louver-based trap in riverine conditions. The team evaluated trap performance with weekly mark-release-recapture trap efficiency trials, conducted daily water quality and hydraulic sampling, and assessed the impact of predation in the vicinity of the trap. The JSCS project involved close collaboration between DWR and the Winnemem Wintu Tribe, and the inclusion of traditional ecological knowledge generated new methods in juvenile salmon capture and sampling. This poster describes the collection system, results from the study, and lessons learned.

Primary Author: Fenton Khan

Affiliation: U.S. Army Corps of Engineers

Title: Engineering Design and Construction of the Dexter Adult Fish Collection Facility for Upstream Fish Passage in Oregon, USA

Key Words: Engineering design, fish collection facility, trap and haul, adult salmon

Abstract:

Multi-purpose dams create barriers for upstream migrating fishes, especially for anadromous fish destined for spawning grounds upstream of the dams. The US Army Corps of Engineers (USACE) own and operate multi-purpose dams in the Willamette River Basin, Oregon, USA. The primary purposes of these dams are flood risk management and hydropower production, along with recreation and irrigation. The flood risk management purpose and the seasonal changes in reservoir elevations preclude construction of fish ladders for upstream migrating fishes to pass, and these dams have fish collection facilities and transport (trap and haul). Many of the fish collection facilities were constructed decades ago, and over time, some of these facilities became less efficient for collecting fish. The Biological Opinion issued by the National Marine Fisheries Service (NMFS) for the continued operation of these dams requires USACE to upgrade the fish collection facilities to current engineering standards to improve upstream passage of Endangered Species Act (ESA)-listed Upper Willamette River Chinook salmon (Oncorhynchus tshawytscha) and winter steelhead (O. mykiss). USACE has upgraded several fish collection facilities since 2014 and is currently upgrading the Dexter Fish Facility (Dexter FF). Dexter FF, constructed in 1955, is located on the Middle Fork Willamette River, downstream of Lookout Point Dam (a high head dam) and Dexter Dam (a regulation dam for Lookout Point Dam). USACE completed engineering design of the upgrades, and construction is underway, with completion scheduled for May 2026. The design team utilized the NMFS Anadromous Salmonid Design Manual and experience from design and construction upgrades of other fish facilities in the Willamette Basin. This presentation will describe the engineering design and construction upgrade of the Dexter FF, including challenges of collecting fish during construction. Lessons learned may inform design of fish collection facilities.

Primary Author: Mary Khoury

Affiliation: The Nature Conservancy, Center for Resilient Conservation Science

Title: A Freshwater Resilient and Connected Network to Sustain Biodiversity Under a Changing Climate

Key Words: freshwater, resilience, prioritization

Abstract:

Over the last century, the ecological integrity of streams and lakes in much of the US has declined, and now climate change is altering historic precipitation and temperature patterns, further impacting freshwater environments. In response to the joint biodiversity and climate crises for freshwater, we asked what makes river networks resilient for biodiversity given these changes? Through engagement with Nature Conservancy colleagues across the US, we hypothesized that a resilient river is one that is part of a large, diverse and connected network, has ample water and has good water quality and an intact flow regime, thus allowing organisms to move, adapt and thrive in a changing world. This presentation will feature our approach to map freshwater resilience and then prioritize river networks by identifying the most resilient rivers that represent recognized freshwater biodiversity. This Freshwater Resilient and Connected Network comprises 35% of the conterminous US and 62% of Alaska. Finally, we assessed the conservation status of our rivers, defining conserved as being resilient and having sufficient freshwater protection. We based on protection analysis on American Rivers Protected River Index combined with an analysis of the regulating function of the contributing area. We found that less than 10% of rivers in the conterminous US and 39% in Alaska are conserved. In addition to discussing methods, this talk will offer examples of conservation professionals using the analysis and accompanying web tool (https://maps.tnc.org/resilienttivers) to assess river resilience and as important context to locate protection and restoration work.

Primary Author: Anna Kladzyk Constantino

Affiliation: McMillen

Title: Advancing habitat restoration for the imperiled Clear Lake Hitch

Key Words: fish passage, habitat restoration, climate change, Clear Lake Hitch

Abstract:

Clear Lake Hitch (CLH) is a threatened species under the California Endangered Species Act (ESA), and in 2025, the U.S. Fish and Wildlife Service proposed a threatened listing for the CLH under the federal ESA. CLH is a minnow species endemic to Clear Lake, the largest freshwater lake in California and oldest lake in North America. In the spring, CLH migrate up the ephemeral tributary creeks of the Lake for spawning. Clear Lake has been a vital source of life and community in the region since time immemorial, and the CLH are a keystone species not only for ecosystem function but also to the Indigenous peoples of the watershed. Settler colonialism activities including mining and commercial agriculture significantly altered the landscape, and contributed to contamination, hydrologic disconnection, habitat fragmentation, and invasive species proliferation. These historic issues are exacerbated by changes in temperature and precipitation patterns in the watershed, resulting in more frequent and severe droughts and wildfires, extreme heat, flooding, and more favorable conditions for vector-borne diseases and harmful algal blooms. Managers responsible for CLH habitat restoration must reckon with the complexity of these interwoven issues to ensure restoration activities are resilient and impactful. Moreover, local community support is essential to advance projects to implementation. Projects must be designed to restore habitat for the CLH while providing co-benefits like flood risk reduction, groundwater recharge, and protection of Tribal Beneficial Uses, among others. This session will highlight three CLH passage restoration projects: Tejada Ranch Habitat Management Project, Xabenapo (Old Robinson) Stream Habitat Enhancement, and the Revitalizing Clear Lake Oaks Initiative.

Primary Author: Andrea Kneale

Affiliation: Manitoba Hydro

Title: Evaluating Fish Passage at an Arch-Culvert Crossing on the Limestone River (Manitoba, Canada)

Key Words: Fish passage, hydraulic modelling, arch-culvert, swimming performance

Abstract:

Road–stream crossings often restrict fish movement in Canadian rivers. At the Limestone River crossing on the Keewatinohk Access Road, twin arch plate culverts may act as partial or complete barriers during key migration periods. To guide near term remediation and long term improvements, we combined 1D/3D hydraulic modelling with swimming performance analysis to assess passage constraints and test an interim in culvert boulder concept.The culverts, built in 1975, require upstream bin protection; proposed rockfill placement would narrow the inlet and encroach into the river channel. Hydraulic simulations (HEC RAS and FLOW 3D) were run for existing and post encroachment conditions under key discharges, including the fall three day 10% exceedance flow (3DQ10; 103 m^3/s). The 3DQ10 occurs rarely (≈4% of the open water season), and historical monitoring (1990–1995) documented upstream passage during fall flows substantially lower than 3DQ10. Fish passage interpretation applied depth criteria (≥0.20 m) and the Department of Fisheries and Oceans' Swimming Performance Observation Tool (SPOT) for Northern Pike, Brook Trout, and Cisco.Results show depth criteria were met, but velocities exceeded swimming capabilities at 3DQ10, with local maxima >5 m/s. SPOT analysis suggests only ~2.5% of individuals could sustain passage along the lowest velocity route, indicating very low success under these conditions. The boulder configuration failed to create continuous low velocity corridors and is not recommended.Overall, findings confirm a velocity barrier under moderate to high migration flows and limited benefit from in barrel roughness elements. Near term bin protection can proceed with a minimized footprint and targeted monitoring, while long term solutions should focus on reducing inlet control and providing continuous low velocity pathways through retrofits or partial re naturalization.

Primary Author: Josef Knott

Affiliation: Aquatic Systems Biology, Technical University of Munich

Title: Physical forces experienced by fish at low-head river infrastructure

Key Words: barotrauma, fish passage, innovative hydropower, sensor fish

Abstract:

Passage of fish through river infrastructure, such as weirs, outlet regulators, and hydropower plants, may expose them to harmful physical forces. Associated injury risks for fish mainly relate to rapid decompression (barotrauma), strikes, and shear stress. In this study, autonomous sensors (Sensor Fish) were used at different types of low-head river infrastructure to quantify decompression, strike, and shear forces that fish may encounter during downstream passage under realistic operating conditions. We found that low-head hydropower plants can pose a high risk of injury and mortality to fish during turbine passage. Even innovative turbines considered 'fish-friendly' are not necessarily less harmful to fish than conventional turbines, as site-specific conditions such as head drop, runner speed, intake water depth, or operation mode decisively influence ecological performance. Besides the injury risk from blade strikes, especially in fast-rotating turbines, rapid decompression can also occur during turbine passage even at low heads, leading to barotrauma injuries such as swim bladder rupture, internal hemorrhaging, or exophthalmia. We also found that fish can face a high injury and mortality risk when passing downstream through low-head overshot weirs or outlet structures. Strike-related injuries can occur if weirs have not been constructed according to regulations and fish hit the concrete base in the tailwater if there is insufficient plunge pool depth, or if fish collide with gates or are exposed to shear forces at high flow velocities. Understanding the hydraulic risks associated with fish passage through river infrastructure is essential not only for assessing ecological impacts but also for guiding management actions. Combining sensor fish data with ongoing research on fish sensitivity to barotrauma can help identify critical aspects related to river infrastructure design and operation, contributing to a less harmful passage for fish.

Primary Author: Jeff Kozlowski

Affiliation: ICF

Title: The Tale of Two Fish Passage Barriers: the Unique Challenges of Restoring Steelhead to Jalama Creek

Key Words: roughened channel, blasting, southern California steelhead, barrier removal

Abstract:

The Nature Conservancy (TNC) recently removed the two most-downstream movement barriers for endangered Southern California steelhead (Oncorhynchus mykiss) and other aquatic species on Jalama Creek on TNC's Jack and Laura Dangermond Preserve in Santa Barbara County, California. Removal of these barriers immediately made approximately 13 miles of spawning and rearing habitat accessible for steelhead, which were last observed in the creek by the California Department of Fish and Game over 30 years ago in 1994. Each of the barriers required creative approaches for removal. The first barrier, an abandoned concrete weir, was located about 0.6 miles upstream of the Jalama Creek estuary at Jalama Beach County Park, effectively preventing steelhead from entering the 24 square mile (62 km2) Jalama Creek watershed. The project site is situated in a narrow canyon at the base of a 220-foot-tall nearly vertical bluff that was only accessible on foot through Vandenberg Space Force Base. This location required the use of explosives and a helicopter to ferry in equipment, remove the barrier and ferry out demolition debris. Labor to break up the concrete was provided by the California Conservation Corps. The second barrier, a perched concrete apron under the county's Jalama Road bridge, was located about 0.8 miles farther upstream and was more accessible to construction crews. To remediate this second barrier, heavy equipment was used to modify the apron and construct a rock ramp/roughened channel. However, despite the greater accessibility, remediation was not without its unique challenges; namely, how to construct the rock ramp/roughened channel without compromising the integrity of the bridge pier footings that were located immediately upstream of this vertical barrier.In addition to diving into the challenges of remediating these two barriers, this presentation will discuss the contrasting local channel responses at each site following three winters of elevated flows post-construction.

Primary Author: Tyler Kreider

Affiliation: Kleinschmidt Associates

Title: NLF Substrate Design, Constructability, and Stability Observations Post-Construction

Key Words: Nature-like Fishway, Roughened Channel, Design, Lessons Learned

Abstract:

The seasonal dewatering of the NLF at the Adam T. Bower Memorial Dam on the mainstem of the Susquehanna River at Shikellamy State Park, presents a unique opportunity to observe the geomorphic processes at work in the NLF. During riprap design, the engineer typically evaluates the proposed substrate stability via a spectrum of methods ranging from scour protection to an aggregate substrate method. After two operating seasons, we will discuss the roughened channel substrate design approach for this fishway and take-aways regarding the stability and biological implications of the installed channel substrate material.

Primary Author: Bjorn Lake

Affiliation: Inter-Fluve

Title: Interagency Fish Passage and Protection Guidelines for Migratory Species in the United States

Key Words: guidelines, policy

Abstract:

In 2022, the U.S. Fish and Wildlife Service, Region 5, and the National Marine Fisheries Service, Office of Habitat Conservation decided to develop a new fish passage and protection facility guidelines document to provide practitioners a resource for implementing a wide variety of fish passage projects from barrier removal to complex technical fish passage solutions at water infrastructure. This publication will supersede some, but not all, existing USFWS and NMFS guidelines (e.g., NMFS' Pacific Salmon guidelines). In this presentation, we will provide an overview of the content and our approach to developing this comprehensive resource. In addition, we intend to make this a working document that evolves over time as fish passage and protection science advances, so we will discuss our anticipated process for future updates and how practitioners can participate.

Primary Author: Mike Lambert

Affiliation: Fish Guidance Systems Ltd

Title: Behavioural technology implementation - lessons learned

Key Words: Case-Studies Lessons learned Technology

Abstract:

This presentation examines recent installations of behavioural technologies and examines the lessons learned from the projects. It will look critically at four projects and assess what went well, and what could be improved. The projects assessed each contain unique challenges and used differing solutions to meet the requirements and expectations of the customers. It will include examining the design journey of each project, from initiation to eventual implementation, highlighting the importance of considered deployment methodology, and system lifecycle management to help to improve future projects allowing them to be installed more efficiently and be maintained more easily.

Primary Author: Steven Leach

Affiliation: FirstLight Power Services LLC

Title: Design, operation, and maintenance of east coast U.S.fishways and the evolution of passage goals

Key Words: fishway design and performance

Abstract:

FirstLight Power Services LLC (FirstLight) operates a variety of fish passage facilities associated with Federal Energy Regulatory Commission licensed and non-jurisdictional hydroelectric projects in the states of Connecticut and Massachusetts in the eastern United States. Facilities include three designs of technical fish ladders, two designs of mechanical fish lifts, eel ramp traps, and a variety of downstream fish bypasses. In this discussion experiences involving the design, modification, operation, maintenance, performance evaluation, and monitoring will be summarized, with emphasis on the Turners Falls Hydroelectric Project (FERC Project No. 1889) and the Scotland Hydroelectric Project (FERC No. 2662). Fish passage efforts at Turners Falls began in 1980 with the operation of a multiple fish ladder system for upstream passage and an innovative design to convert an existing debris sluice for downstream passage. Forty-six years of operation, observation, study, and analyses of those facilities resulted in a settlement agreement for (ongoing) re-licensing that was derived through the lens of evolving fish passage goals and performance standards. The settlement intends to replace the existing fish ladder system with a more resource intensive mechanical fishway, among other flow and fish passage articles. In addition, the agreement incorporates specific evaluations with pre-determined passage performance goals and adaptive management. Upstream and downstream fish passage was implemented at the Scotland Project beginning in 2018 and included an innovative exit flume design to fit a mechanical fish lift into the available footprint. Observation and evaluation over the first few years of operations resulted in several design modifications. Passage performance studies and agency consultations are ongoing. Meanwhile, operations, maintenance, and monitoring efforts continue annually.

Primary Author: Dale Lentz

Affiliation: U.S. Bureau of Reclamation

Title: Lower Yellowstone Intake Fish Bypass Project

Key Words: Fish Bypass pallid sturgeon

Abstract:

The Lower Yellowstone Intake Fish Bypass Project evaluates the effectiveness of a large-scale engineered bypass channel in restoring upstream connectivity for endangered pallid sturgeon and other native fishes while sustaining irrigation diversions for the Lower Yellowstone Irrigation Project. This is a joint federal effort led by the Bureau of Reclamation, in coordination with the U.S. Army Corps of Engineers and the U.S. Fish and Wildlife Service. The historic Intake Diversion Dam (1909) created a barrier to upstream movements of bottom-oriented fishes, contributing to limited recruitment of pallid sturgeon in the Yellowstone and Missouri rivers.The project was implemented in two primary phases: installation of a state-of-the-art fish screen and headworks (completed 2012), and replacement of the diversion weir and a nature-like hydraulically optimized bypass channel (completed 2022). The bypass extends ~11,000 ft, is 150–200 ft wide, and conveys ~15 % of river flow. It was designed to meet Biological Review Team criteria for depth, velocity, and flow distribution across a broad range of discharges.Hydraulic conditions were quantified using Acoustic Doppler Current Profiler surveys, and fish passage was evaluated with radio and acoustic telemetry. Monitoring confirms that hydraulic conditions throughout the bypass meet design criteria, and telemetry shows high upstream passage success for pallid sturgeon across flow conditions. Passage success has also increased or remained high for paddlefish, shovelnose sturgeon, sauger, and blue sucker, with all native species documented using the bypass.Since construction, pallid sturgeon have been documented in restored habitat extending an additional 164 mi of the Yellowstone River, 20 mi of the Tongue River, and 221 mi of the Powder River. The Lower Yellowstone Intake Fish Bypass Project demonstrates how integrated design, monitoring, and adaptive management can restore longitudinal connectivity and advance species recovery while maintaining reliable irrigation infrastructure.

Primary Author: Antonio Lopez

Affiliation: Pacific Northwest National Laboratory

Title: Evaluating Downstream Fish Passage at a High-Head Flood-Control Dam to Inform Design

Key Words: Fish passage, Dam passage survival, Sensor Fish, Hydraulic stressors

Abstract:

The U.S. Army Corps of Engineers is designing a Fish Passage Facility (FPF) at Howard A. Hanson Dam (HAHD; Washington State, USA), a high-head (70 meters tall) flood-risk management facility, to provide safe downstream fish passage for Endangered Species Act-listed species. Downstream flows are conveyed via a long outflow tunnel through the dam that operates over a wide range of discharges, resulting in variable hydraulic conditions within the outlet works. Information on downstream passage conditions and fish survival at HAHD is currently limited. To establish baseline conditions and inform the FPF design, Sensor Fish (SF) were deployed to characterize hydraulic stressors and estimate fish survival, with 449 releases conducted across nine operating conditions. SF data were analyzed using the Hydropower Biological Evaluation Toolset (HBET) to identify critical events such as collisions, strikes, and shear, locate regions of elevated risk along the passage, and relate hydraulic events to biological response through a velocity-based strike metric (Mv). Laboratory testing under simulated passage conditions was used to establish mortality thresholds for Mv, and results were validated using live fish testing and Computational Fluid Dynamics modeling (CFD). Across operating conditions, collision-related events were the dominant hydraulic stressor, whereas shear exposure was infrequent and pressure effects were minimal. The upstream tunnel transition was identified as the primary contributor to predicted injury and mortality, with a strong correlation ($r=0.74$, $p=0.03$) between the proportion of SF releases experiencing severe acceleration events and live fish mortality. This relationship was supported by maximum Mv exposure, which showed a stronger correlation ($r=0.89$, $p=0.002$). Overall, live fish injury and mortality during downstream passage at HAHD were strongly associated with collision-driven acceleration events at geometric transitions, with SF successfully identifying the primary mechanisms influencing passage risk and supporting evaluation of future passage alternatives.

Primary Author: Michael Love

Affiliation: Michael Love & Associates, Inc.

Title: Considering Boulder Layouts and Hydraulic Resistance in 2D Models of Nature Like Fishways

Key Words: Nature-like Fishways, Hydraulic Modeling, Post-project Monitoring

Abstract:

Designing hydraulics for nature like fishways (NLFs) is nonstandard and relies heavily on judgment. Achieving fish passable conditions across a wide flow range requires careful channel geometry and detailed boulder layouts, and iterative refinement depends on numerical simulation. Two dimensional open channel models such as HEC RAS are now standard for NLF hydraulics, but they require an assumed hydraulic resistance coefficient (e.g., Manning's n). When boulders are explicitly represented in the model terrain, much of the form resistance is captured by the geometry, leaving the resistance coefficient to represent mainly surface friction. Most published roughness values and empirical equations for boulder channels were developed for one dimensional models and therefore include form losses, creating a mismatch for 2D simulations. This presentation summarizes data collection techniques and findings from two scaled physical models and post construction monitoring of three NLFs, presents back calculated Manning's n values for design and as built channels with and without explicit boulder representation, discusses layout and modeling considerations, and offers recommendations for applied research to improve NLF design practice.

Primary Author: Anna Mallonee

Affiliation: HDR Engineering, Inc.

Title: A Review of Partial Depth Guidance Systems: Lessons Learned

Key Words: guidance systems

Abstract:

Partial depth guidance systems may be preferred due to their cost, compared to full depth screens, but when are they appropriate for providing downstream fish guidance? To better understand the use and efficacy of partial depth guidance systems at fish passage facilities, we conducted a literature review and outreach exercise. This effort included engagement with regulatory agency representatives, engineering and biology consultants, and industry experts to capture both documented performance data and practitioner experience. We compiled available information and analyzed data to identify any potential correlations between a variety of physical factors and measured performance. In this presentation, we explore the application of partial depth guidance systems at specific downstream passage facilities and summarize key lessons learned from both published studies and professional practice. While system performance can vary by site and design, this presentation offers a professional opinion on when confidence levels are higher for successful implementation.Both quantitative and qualitative information will be shared to support project planning, design, and evaluation of partial depth guidance systems for downstream fish passage.

Primary Author: Amiana Manser

Affiliation: Jacobs Engineering

Title: From Engineers to Ecologists: Using 2D Hydraulic Modeling to Integrate Habitat Features into Fish Passage Projects

Key Words: 2D modeling, Habitat Design

Abstract:

Two-dimensional hydraulic modeling tools such as HEC-RAS 2D and SRH-2D have become essential for engineers, biologists, and geomorphologists working on stream restoration and fish passage projects. As restoration designs increasingly rely on habitat features to achieve ecological outcomes, accurately representing hydraulic complexity has become more important. Traditionally, hydraulic models have relied on a single composite Manning's n value to represent channel roughness. While this approach often meets engineering needs, it oversimplifies the complexity introduced by habitat features like large wood and boulders - elements critical for ecological function.This presentation explores methods for explicitly incorporating large wood into hydraulic models by comparing composite roughness with discrete roughness zones applied to habitat features. We emphasize how small adjustments to these discrete roughness zones can produce substantial shifts in predicted flow patterns, altering velocity distribution and potential habitat availability. Highlighting this sensitivity is a key outcome of our work, with direct implications for restoration design decisions. This approach also strengthens interdisciplinary communication and design decision making.

Primary Author: Allen Mensinger

Affiliation: University of Minnesota Duluth

Title: Multi-modal acoustic and carbon dioxide deterrent stops the upstream passage of bigheaded carp

Key Words: conditioning, native fishes, acoustic deterrent, lock /dam

Abstract:

Broadband sound has been effective as an acoustic deterrent to inhibit the passage of bigheaded carp. However, there is concern that fish will eventually habituate to a single deterrent and its effectiveness will decrease over time. In this study, the acoustic deterrent was augmented by carbon dioxide dissolved in the water. Bigheaded carp were conditioned to associate sound with carbon dioxide release in a model lock and dam tank. Following two days of conditioning (n=6 applications), the acoustic deterrent was 100% effective over one week in blocking the upstream passage of both silver and big head carp including schools that were food motivated to reach the upstream pool. However, to better assess field populations, where new immigrants may avoid or arrive between carbon dioxide applications, mixed schools consisting of conditioned (30%) and naïve (70%) were tested. The deterrent was over 98% effective in preventing upstream movement with only a single naïve fish passing upstream among the eight schools (n=80 fish) during the trials that included 28 gate openings over a one week period. This indicates that conditioned fish can influence the behavior on naïve fish. Habituation to the acoustic deterrent was not observed as fish lock chamber entries declined significantly over the course of the study. Ongoing studies with native fish including big mouth buffalo and sturgeon show the multimodal deterrent to have minimal effect on upstream passage with the majority of the fish reaching the upper pool during the trials.

Primary Author: Hugo Marques

Affiliation: Fishtag Consultoria Ambiental

Title: Modeling hydrological and operational interactions on fish attraction in a pump-attraction passage system in an Amazonian river

Key Words: Fish passage, Trap-and-haul, Pump-attraction system, RFID (PIT telemetry)

Abstract:

The Teles Pires River, part of the Amazon basin, is home to important hydroelectric projects, whose impacts on migratory fish fauna demand specific mitigation strategies. In the middle course of this river, the Sinop Hydroelectric Power Plant (UHE Sinop) implemented a trap-and-haul fish passage system (SMTP), with the main objective of maintaining the long-term genetic viability of populations upstream of the dam and, to a limited extent, ensuring the continuity of upstream migration.The SMTP consists of an entry channel with pump-based attraction, a confinement screen, an elevation system, and truck transport to the upstream release area. The system is monitored using RFID (PIT telemetry) to record the entry of tagged individuals, enabling continuous, remote monitoring of the system's attraction efficiency.To evaluate the influence of operational and hydrological variables on the daily number of individuals detected at the SMTP entrance, data collected between August 2022 and May 2024 were analyzed. Downstream water level, turbine and spillway flows, and the number of operating pumps were considered. Given the pattern of overdispersion and excess zeros in the data, Generalized Linear Models with a Negative Binomial distribution were fitted, with selection of the most parsimonious model based on AIC (Akaike Information Criterion) and bootstrap resampling.The results indicate that the downstream water level is the main factor conditioning the SMTP's attraction efficiency, showing a consistent positive effect. The intensification of pump operation significantly increases the number of individuals detected, especially under intermediate to high downstream levels and moderate or low turbine flows. In hydrologically unfavorable scenarios, characterized by low downstream levels and high turbine flows, the ecological return from operational intensification is reduced. The results reinforce the importance of adaptive SMTP operation, guided by favorable hydrological windows, as a tool to maximize biological efficiency and optimize operational effort.

Primary Author: Gabriel Martin

Affiliation: Kleinschmidt Associates

Title: Susquehanna River NLFs: Construction Considerations

Key Words: Nature-like Fishway, Construction, American Shad, Lessons Learned

Abstract:

To improve aquatic connectivity for American Shad on a major US East Coast River, two nature-like fishways were recently completed on the mainstem of the Susquehanna River at the York Haven Dam and Adam T. Bower Memorial Dam (at Shikellamy State Park). As each NLF design transitions from plan sheet to riprap and boulders, there are often lessons learned that can inform other fishway designs. The subsurface geotechnical and concrete investigations, stone material sourcing, optimizing seasonal flows, and photo documentation will be discussed.

Primary Author: Jayson Martinez

Affiliation: Pacific Northwest National Laboratory

Title: Cloud-connected real-time acoustic telemetry receiver networks for fishway monitoring and receiver health awareness

Key Words: Acoustic telemetry, real-time monitoring, remote diagnostics, hydropower dams

Abstract:

Acoustic telemetry is widely used to quantify fish passage and behavior at hydropower facilities or adjacent sections of rivers, yet many receiver deployments still rely on onboard logging that must be retrieved in person. Locations such as fishways are harsh environments: high flows and debris loading can foul or damage in-water components, and failures may remain unknown until the next site visit, often requiring hours of travel, creating avoidable data gaps. Real-time access to detections provides practical situational awareness, including remote confirmation that expected reference-beacon detections are present and timely indication when maintenance is needed.We developed a distributed, cloud-connected monitoring workflow that converts real-time receiver output into remotely accessible, time-binned detection files and basic health indicators. Serial receiver messages are forwarded through a network bridge to a field gateway computer that can ingest multiple receivers, log detections locally, and upload hourly detection files to a cloud endpoint using store-and-forward buffering to preserve continuity during network interruptions and support automated backfill when connectivity returns. As a case study, the system was deployed for adult Pacific lamprey (Entosphenus tridentatus) monitoring on the Columbia River, with 40 receivers installed between Bonneville Dam and The Dalles Dam to monitor adult fish ladder use. Over five months of operation, the system automatically uploaded hourly detection files from each receiver and enabled rapid response to suspected issues (e.g., vegetation fouling or impact damage), limiting downtime and data loss in a challenging fishway setting. We further demonstrated the same workflow for mobile tracking by conducting drift surveys with two boats (four receivers per boat) over ~80 km between The Dalles Dam and Bonneville Dam to identify potential holding areas. Together, these deployments illustrate how real-time receiver networks can support monitoring through structures, distributed arrays in forebays or tailraces, and mobile surveys along river reaches.

Primary Author: Paul Matson

Affiliation: Oak Ridge National Laboratory

Title: A regional comparison of fish passage infrastructure at US hydropower developments

Key Words: hydropower, fish passage, facilities

Abstract:

Hydropower provides Americans with reliable, affordable energy and helps stabilize the power grid; however, hydropower dams may limit or prevent the movement of migratory fishes within river systems. Consequently, hydropower developers may be required to install fish passage facilities as a condition of their federal licenses or as stipulated by other stakeholders or legislation. The requirement to provide fish passage depends on many factors and there are different technologies available, each with their own set of engineering specifications, that can be installed to provide passage to migratory fish. Until recently, regional comparisons of the implementation of fish passage infrastructure for different taxonomic groups have not been possible due to the lack of centralized data on a national scale. We addressed this gap in knowledge by comparing the distribution of passage existence and technology type at fish passage facilities between distinct US hydrologic regions using the National Hydropower Fish Passage Database. Our analysis revealed that regional patterns in passage existence appear to outweigh taxonomic-driven patterns. We also found that hydropower feature characteristics may help us predict passage existence at features for which the database does not provide information or anticipate which features may be required to install fish passage during the hydropower licensing process. Finally, we identified regional, species, and feature-characteristic patterns in the direction and type of fish passage facilities installed across the country. Understanding the mechanisms that drive where and how fish passage is mitigated at hydropower developments is important for anticipating how these mitigations may be applied under evolving grid, regulatory, and environmental conditions and to assess the efficacy of different fish passage technologies.

Primary Author: Dana McCoskey

Affiliation: U.S. Department of Energy Water Power Technologies Office

Title: Fish Passage Research and Development Pathways

Key Words: Hydropower, Upstream passage, Downstream passage, Technology R&D

Abstract:

The U.S. Department of Energy's Water Power Technologies Office (WPTO) funds innovative fish passage R&D including monitoring technologies, testing of novel fish passage designs, and foundational science to improve the environmental performance of hydropower. WPTO will present a summary of feedback from comprehensive outreach and engagement with the hydropower industry, resource and regulatory agencies, tribes, non-governmental organizations, technology developers and other strategic partners that have informed R&D needs and highlighted opportunities for collaboration. WPTO will share areas of interest that have potential to be advanced through scientific research and multidisciplinary partnerships as they relate to a WPTO 5-year strategic plan.

Primary Author: Danie Merriman

Affiliation: Idaho Power Company

Title: Hell and High Water: A Field Campaign to Calibrate a TDG Model for Assessing Deflector Design at Hells Canyon Dam

Key Words: TDG, hydropower, spillway, dams

Abstract:

The Hells Canyon Complex on the Snake River—located along the Idaho–Oregon border—consists of three hydroelectric projects that supply roughly 70% of Idaho Power's annual hydroelectric generation and about 30% of the total energy generated for the company. The most downstream facility, Hells Canyon Dam, produces 450 MW of energy, drains a 73,300-square-mile watershed, and operates with 220 feet of head. While operations are designed to minimize spill, spill does occur during high-flow years. Spill over the steep structure entrains atmospheric gases, creating total dissolved gas (TDG) supersaturation that can adversely affect aquatic organisms. Idaho Power has monitored TDG downstream of the complex periodically since the 1970s to evaluate supersaturation behavior and identify effective mitigation measures. In 2025, Idaho Power conducted expanded monitoring to quantify TDG dynamics downstream of Hells Canyon Dam under multiple controlled operational scenarios. A bank-mounted sensor located 1.2 miles below the dam collected continuous TDG measurements over a six-month period. To characterize spill-induced TDG supersaturation, Idaho Power also collected cross-sectional TDG data near the dam face during a controlled spill event using a boat-mounted sensor. These datasets were used to refine and calibrate an existing computational fluid dynamics (CFD) model, resulting in improved predictive accuracy for TDG generation and transport across various spill and flow configurations.The calibrated CFD model enhances understanding of TDG processes below Hells Canyon Dam and will inform potential flow-deflector designs, monitoring strategies, and fish-trap performance. This combined monitoring-and-modeling framework will also be applied to the two upstream projects to support systemwide TDG assessment and aquatic habitat protection.

Primary Author: Joseph Merz

Affiliation: Cramer Fish Sciences

Title: Setting the Stage: Connecting Processes, Habitat Access, and Migration Success in the Lower Merced River

Key Words: Process Based Restoration, Partnership Revitalization, Barrier Remediation, Strategic Reintroduction

Abstract:

Regulated rivers in California's Central Valley function within tightly constrained physical, ecological, and social systems. Altered flow regimes, sediment starvation, simplified channels, and disconnected floodplains—combined with water diversion infrastructure, invasive species, and legacy channel modifications—continue to limit habitat quality, habitat access, and overall migration success. In Mediterranean-climate rivers such as the lower Merced, these challenges are intensified by highly seasonal hydrology and competing demands for limited water supplies. This introductory presentation frames the lower Merced River as a working landscape where improving migration success depends as much on restoring river processes and habitat access as on reducing individual barriers. Constraints extend beyond dams and structures to include disrupted flow cues, poorly screened diversions, and predator-dominated deep pools and disconnected floodplains remnants of historic mining that hinder juvenile habitat access and migration success. Collectively, these conditions reduce survival across multiple life stages of Chinook salmon and other native species, even where structural barrier-reduction actions have occurred. Using the lower Merced River as a case study, this talk introduces a systems-based approach that integrates restoration of hydrogeomorphic processes, remediation of migration barriers, reintroduction of fish into suitable and accessible habitats, and revitalization of partnerships among practitioners, water managers, NGOs, and local communities. Rather than focusing on individual projects, this presentation outlines a programmatic framework for decision-making below the lowest non-passable barrier—identifying limiting factors, sequencing actions, and balancing passive recovery with targeted, nature-based interventions. The goal is to establish a shared context and vocabulary that prepares the audience for three subsequent talks examining restoration priorities, strategies for improving migration success, habitat access, predator–habitat dynamics, and floodplain design under regulated flows.

Primary Author: Hailey Mico

Affiliation: California Department of Water Resources

Title: Wallace Weir Fish Rescue Facility: The Trailblazing Sacramento Valley Fish Passage Project

Key Words: engineering, flood bypass, migration

Abstract:

Wallace Weir is located in the Knights Landing Ridge Cut Slough, an agricultural stream that drains into the Yolo Bypass. Historically, adult migratory fishes such as salmonids and sturgeon that were drawn into the Yolo Bypass could swim over the earthen weir during moderate and high flow events, straying into the dead-end Colusa Basin Drainage Canal. In 2013, roughly a third of the endangered winter run spawning population strayed past Wallace Weir, highlighting a need to redesign the weir. Using grant funds provided by the US Army Corps of Engineers, the Wallace Weir Fish Rescue Facility (Facility) was constructed in 2017 as a collaborative effort between the California Department of Water Resources and Reclamation District 108. RD 108 and CDFW operate the upgraded Facility to pass excess flows and rescue fish before they stray into the Colusa Basin Drainage Canal. The Facility is comprised of three bottom-hinged water control gates, six downstream fish protection picket weirs, and a fish collection facility to corral and rescue the target fishes including Chinook Salmon, steelhead, White Sturgeon, and Green Sturgeon. The Facility has allowed for the successful rescue and relocation of thousands of adult anadromous fishes that would have otherwise been lost to the population. The Facility has proven to be a success protecting adult listed anadromous fishes in the Yolo Bypass. Although the Facility is not a traditional volitional fish passage project, completing it was a key step towards future Yolo Bypass fish passage projects. This first-of-its-kind project laid the groundwork for and built momentum towards future Yolo Bypass fish passage projects including the Fremont Weir Adult Fish Passage and the Big Notch Project.

Primary Author: Marshall Moore

Affiliation: Mark Thomas

Title: Accommodating Terrestrial Movement through Typical Bridge Designs

Key Words: Terrestrial connectivity bridge

Abstract:

The integration of wildlife connectivity into bridge design is increasingly recognized as essential for maintaining ecological integrity and supporting biodiversity. This presentation examines three case studies—Campus Parkway, Bolinas Bridge, and Pacheco Pass—where projects adapted typical structures to facilitate both aquatic and terrestrial wildlife movement.At Campus Parkway a new four-lane arterial bisects Bear Creek and its riparian corridor. By constructing a large bridge structure which avoided impacts on the creek, fish passage was preserved, and substantial openings were provided to support terrestrial movement along the riparian corridor. This approach avoided creating a connectivity pinch point and eliminated the need for extensive wildlife fencing, leveraging the natural travel routes of animals in an agricultural landscape.The Bolinas Bridge project replaced a culvert with a long-span bridge featuring open abutments, exceeding flood conveyance requirements and enhancing fish and terrestrial connectivity. Innovative design choices, such as eliminating abutment foundations due to poor soil conditions and supporting the bridge on piers, reduced construction impacts and costs. The new bridge, while not critical to larger animals, benefits smaller species, such as banana slugs, preventing the formation of biodiversity islands.As part of the Pacheco Pass wildlife crossing project, a linkage analysis, spatially explicit decision support (SEDS) analysis, and alternatives analysis were completed to inform the best wildlife crossing location within the Pacheco Pass corridor. The usage of existing SR 152 bridge and culvert structures as terrestrial wildlife crossings were examined as part of the analyses. Crossing locations were identified, and wildlife fencing was implemented as part of a separate but related project within the corridor to encourage animal use of these existing hydraulic structures, supplementing the proposed overcrossing.These examples demonstrate how bridge projects, driven by flood conveyance requirements, can be designed to enhance both fish passage and terrestrial connectivity. By increasing bridge spans and reducing abutment heights, ecological impacts are minimized and construction costs are managed, illustrating the mutual benefits of integrating wildlife connectivity into infrastructure planning.

Primary Author: Paul Morgan

Affiliation: River and Fish Engineering Solutions

Title: Design and Construction of Fish Screen Facilities in Complex Braided River Systems

Key Words: Fish Screening, Braided Rivers, Intakes

Abstract:

In Canterbury, New Zealand large, braided rivers from the mountains flow across the plains to the sea. Many irrigation schemes are now required to include systems to exclude fish and safely keep them within the river. This presentation will describe examples of recent projects and the many challenges that are encountered within river intake systems and how the integration of a fish screen facility needs to not only follow good practice in screening fish but ensure that the social, environmental and indigenous values are included within the solutions developed. The complex functions of a river intake in managing flows, sediment, debris, floods and safety are combined with all these requirements to find solutions to best protect fish. In many examples the fish screen is being retrofitted within existing infrastructure that was designed and constructed often many decades earlier without consideration of effects on fish. In some examples the infrastructure has developed important habitat and the values that are linked to that then become part of the assessment and development of solutions.The examples I will present are all ones that I have been responsible for developing solutions for. The processes have included working with the owners, environmental groups, iwi (indigenous tribes) and with ecologists and engineers.

Primary Author: Mitchell Morse

Affiliation: U. S. Geological Survey

Title: Diversion Dam Modifications Decrease Canal Entrainment and Improve Downstream Dam Passage for Juvenile Chinook Salmon and Steelhead

Key Words: Behavioral guidance structure, fish passage, diversion dam, entrainment

Abstract:

Entrainment into unsafe passage routes at dams negatively affects migratory fish species worldwide. In the Yakima River, Washington, juvenile salmon entrained into irrigation canals experience migration delay and elevated mortality at several mainstem diversion dams, resulting in management interest to develop fish passage improvements at these sites. We conducted a study at Sunnyside Diversion Dam to evaluate the effectiveness of dam modifications (floating guidance boom and sluiceway Obermeyer gate) for reducing canal entrainment. We tagged 2,832 juvenile Chinook salmon and steelhead and monitored their behavior using acoustic telemetry. Entrainment rates and forebay residence times were evaluated during a six-year study that spanned pre- and post-modification phases, each lasting three years. For all species, overall entrainment rate declined from 41% to 29% after modifications occurred. Entrainment reduction varied with percent of flow diverted into the canal. For example, when the canal received 25% of river flow, entrainment probability estimates declined from 41% (pre-modification) to 20% (post-modification). When the canal received 60% of river flow, estimates were 97% and 91% respectively. Dam modifications not only reduced entrainment but also shortened forebay residence times, which were inversely related to total flow. These findings demonstrate significant improvement to fish passage at a diversion dam following relatively simple modifications to dam infrastructure.

Primary Author: Bob Mueller

Affiliation: Pacific Northwest National Laboratory

Title: Juvenile Pacific Lamprey Passage Behavior and Survival in the Lower Snake and Columbia Rivers

Key Words: Pacific Lamprey, Hydropower, acoustic tag, fish survival

Abstract:

Juvenile Pacific Lamprey (Entosphenus tridentatus) were collected at juvenile fish facilities of mainstem dams located on the lower Snake and Columbia rivers from 2022 to 2025 and implanted with eel/lamprey acoustic transmitters (ELATs). Tagged fish were released approximately 15-20 km upstream of Lower Granite, McNary, John Day, The Dalles, and Bonneville dams between late February and July. Their reach survival, migration rates, routes of dam passage, and overall survival were evaluated using downstream detections on cabled and autonomous receivers. Dam passage survival for the acoustic-tagged lamprey detected passing the dams was estimated using the Virtual Release/Dead Fish Correction (ViRDCt) release/recapture model. Specific dam passage routes, migration rates, and reach survival estimates varied among locations and throughout the study period. In general, we observed a decreasing trend in dam passage survival as lamprey moved downstream, as well as a decrease in survival probability over the season as water temperatures increased. In the lower Snake River, dam passage survival probability ranged from 0.85 to 0.91 at Lower Granite Dam in 2022 and 2023. Passage survival probability at Lower Monumental Dam was 0.84 in 2023. Cumulative survival probability from Lower Granite Dam to Ice Harbor Dam near the mouth of the Snake River (~150 km), was estimated to be 0.51 and 0.48 in 2022 and 2023, respectively. In the Columbia River, dam passage survival at McNary and John Day Dams ranged from 0.71 to 0.74 in 2024. The reach survival probability estimate from McNary Dam to John Day Dam (120 km), was 0.06. In 2025, estimated dam passage survival probabilities at The Dalles and Bonneville were very similar at 0.71. Cumulative survival probability for lamprey detected at The Dalles Dam to Oak Point in the estuary (~ 225 km), was estimated to be 0.02 and from Bonneville Dam to Oak Point (150 km) at 0.12 for lamprey released upstream of Bonneville Dam.

Primary Author: Stephanie Müller

Affiliation: Vattenfall AB, Research & Development

Title: Exploring juvenile trout (Salmo trutta) passage behaviour in a closed vertical slot fishway

Key Words: Vertical-slot fishway, closed fishway design, fish passage, juvenile trout behaviour

Abstract:

High-head hydraulic structures pose unique challenges for fish passage. Large elevation differences and fluctuating reservoir levels make conventional solutions like stepped fishways impractical and costly, as steep slopes and non-uniform flow often create hydraulics unsuitable for fish passage. To ease these constraints, we converted a conventional open vertical slot fishway (VSF) into a closed, pressurized system without a free water surface, aiming to enable steeper slopes and potential underground installation. We experimentally compared the passage behaviour of juvenile brown trout (Salmo trutta, 0.14±0.006m) in an open and closed VSF under bright and dark conditions, using a side-by-side model at Vattenfall R&D's laboratory in Älvkarleby, Sweden. Both fishways had a 5% slope, were 3.78m long and 0.48m wide, and shared identical geometry; however, the closed VSF was sealed with a Perspex lid at 0.12m height to eliminate the free surface. Experiments ran at 0.005m^3/s and 0.14m downstream depth to create comparable flow conditions.Although overall flow was similar, two distinct patterns emerged. In the open VSF, a high-velocity jet impacted the opposite wall, creating a large recirculation zone in the pool centre. In the closed VSF, the lid caused the jet to curve gently, forming large recirculation zones on either side. Despite these differences, VSF design did not affect the maximum proportion of fish or time to reach upstream. Higher activity (i.e., total number of pool transitions) occurred in the open VSF, likely due to more resting zones. Under dark conditions, upstream passages nearly halved, fish spent more time inside, and activity concentrated at the entrance.Lower activity in the closed VSF suggests a more direct, energetically favourable passage. Combined with comparable passage success, this highlights its potential as a flexible, space- and cost-efficient alternative to open-channel VSFs. Reduced performance under dark conditions indicates illumination must be considered for underground installations.

Primary Author: Angelica Mullins

Affiliation: Normandeau Associates

Title: Surgical Implantation of Micro Acoustic Tags in Juvenile American Shad for Evaluation of Route of Passage and Delay of Passage on the Lower Susquehanna River

Key Words: Telemetry, Anadromous, Passage, Hydroelectric

Abstract:

Normandeau Associates, Inc. utilized new acoustic telemetry technology, surgical, and holding methods developed by Pacific Northwest National Laboratories (PNNL), for successful surgical implantation of a micro 'shad' tag. This 416.7kHz tag is compatible with PNNL's JSATS (Juvenile Salmon Acoustic Telemetry System), a weight of 0.05 grams in air, and has dimensions of 7.6 x 2.0mm (Deng et al., 2015; Deters et al., 2024a, 2024b). This new tag technology has been successfully implanted in juvenile American shad as small as 60mm in total length. The acoustic array, located in the headrace and within the York Haven Hydroelectric forebay used a combination of Advance Telemetry Systems (ATS) autonomous SR3002 and shore-based SR3017 Trident acoustic JSATS receivers. The final headrace and forebay array consisted of 12 receivers resulting in 2D tracking capabilities (Deng et al., 2011). Following optimized tagging protocols by Deters, juvenile American Shad were surgically tagged with PNNL micro transmitters in event batches of 50 fish along with 50 control fish (2024a). Tagged fish were held in a specialized air-lift tank with a static brackish oxygenated system for approximately 24-hours post tagging with freshwater flow through introduced after the 24-hour mark (Deters et al., 2024b). Control received the same post-tagging treatment but were held for 7 days to determine tag retention and post-surgery survival. Through 2D tracking of the fish throughout their passage in combination with the tailrace array, the total number of valid tagged fish included in data analysis for this study was 221 juvenile American shad. Each group of fish showed distinct behavioral patterns and aggregations within the forebay and use of 2D tracking allowed fish aggregation areas to be identified as well as route selection for passage, and time analysis.

Primary Author: Christoffer Nagel

Affiliation: Aquatic Systems Biology, Technical University of Munich

Title: Improving freshwater fish conservation through stakeholder involvement- a case study from the River Inn (Germany)

Key Words: stakeholder integration, fish conservation, adaptive management, knowledge co-production

Abstract:

Freshwater fish populations are facing steep declines, increasing the need for effective conservation strategies that integrate multiple stakeholder groups. The River Inn system – a highly modified large alpine river in central Europe – serves as a case study where all stakeholder groups, including practitioners, NGOs, governmental institutions, and scientists closely collaborate to improve fish conservation. In this project, a broad methodological toolbox is applied, ranging from classical approaches to a large PIT tag infrastructure, through which the functionality of structural restoration, improved connectivity and the success of stocking practices is assessed. Stakeholder involvement includes all critical steps, from defining the most pressing knowledge gaps, to participation in data collection, as well as joint discussion and implementation of improved habitat restoration and fisheries management. Stakeholder interaction is institutionalized through a project advisory board and regular meetings, where key findings are discussed and future research and management priorities are jointly defined in line with the principles of adaptive management and knowledge co-production. Knowledge transfer is further supported by open access publishing of both success and failures, and by translating scientific results into practical guidelines, lectures and workshops. Based on this long-term collaborative framework, we identify key pillars for successful stakeholder integration that are transferable to other river restoration projects and fish conservation initiatives worldwide.

Primary Author: Christoffer Nagel

Affiliation: Aquatic Systems Biology, Technical University of Munich

Title: New insights into the applicability of PIT tags and antenna systems

Key Words: fish monitoring, fish tagging fish tracking, PIT tags

Abstract:

The increasing and diverse use of PIT tags in fish monitoring requires a sound methodological evaluation to validate their applicability. This requires both knowledge of the suitability of different PIT tagging techniques for target species as well as on the performance of antenna systems, particularly regarding detection ranges. In the context of a large and long-term PIT-based monitoring along the River Inn in Germany, we assessed different PIT tagging positions (intraperitoneal, pelvic girdle, dorsal) in relation to survival, growth and tag retention in species where such knowledge was incomplete. Irrespective of the tag position, PIT tags showed no effects on survival and growth in the different species compared to untagged control groups and tag retention was high across all species and tagging positions. In addition, we evaluated the detection probability of these different tagging positions in relation to differing distances between the tagged fish and the antenna. This experiment revealed highest detection probability in ventral tag positioning and lowest detection probability in the intramuscular dorsal placement in combination with pass-over antennas. To test the applicability of a mobile floating PIT tag antenna under different environmental scenarios, we used a combination of controlled laboratory experiments and realistic field trials. In this study, different tag-to-antenna distances, tag assemblages, and environmental variables such as salinity, turbidity, sediment and macrophyte cover were tested. Antenna performance was solely determined by tag-to-antenna distance with a sharp decrease in detection probability at > 38 cm between tag and antenna. Such knowledge on tagging applicability and antenna performance is crucial for accurately interpreting PIT tag data collected in the field.

Primary Author: Kevin Nebiolo

Affiliation: Kleinschmidt Associates

Title: From Individuals to Schools: A Behavior-Centered Rethink of Fish Passage Design

Key Words: Behavior Informed Design; Agent Based Models; Schooling Behavior

Abstract:

Traditional fish passage design focuses on the swimming capabilities of an individual fish, yet migrating fish rarely move alone. Species such as salmon, herring, shad, and alewives migrate in dense schools whose collective behavior fundamentally alters how they approach, evaluate, and traverse hydraulic obstacles. These social dynamics create congestion, queuing, drafting, fallback–reentry cycles, and crowd-driven delays that are invisible to standard design guidance but measurable in the field.This talk introduces the concept of Behavior-Informed Design, a framework that integrates individual biomechanics with collective behavior to better predict and improve fish passage outcomes. Using a hydraulically explicit agent-based model built for sockeye salmon at Nuyakuk Falls, we show how schooling, spatial memory, local social cues, and density-dependent interactions control route choice, energy expenditure, and passage efficiency across a range of flows. Results demonstrate that biological capacity is not solely a function of hydraulic capacity: it emerges from crowd dynamics. Even a well-designed entrance can underperform when the school compresses into a narrow wetted corridor, while small structural changes can unlock disproportionately large improvements in flow alignment and social throughput.By recognizing that fish move as coordinated groups, not isolated swimmers, engineers can design passage structures that perform more predictably, more equitably across flows, and more resiliently under climate-driven hydrologic changes. Behavior-Informed Design bridges ecology and engineering to answer a simple but overlooked question: Are we designing passage for a fish, or for a school?

Primary Author: Maranda Nemeth

Affiliation: NOAA Fisheries

Title: Walton's Mill Dam Removal in Maine Restored Atlantic Salmon Habitat Connectivity and Floodplain Wetland Function

Key Words: dam removal, wetland function, Atlantic salmon

Abstract:

The Sandy River watershed in western Maine and its cold, spring-fed streams are prime habitat for wild Atlantic salmon and co-evolved species. However, several dams have impeded access to this habitat. The Atlantic Salmon Federation and the Town of Farmington, with funding and technical support from partners, spearheaded the removal of Walton's Mill Dam on Temple Stream to restore aquatic connectivity and floodplain wetland function while reducing flood extremes, providing recreation improvements, and resolving dam repair and regulatory burdens. The dam was successfully removed in 2022. This presentation will review the monitoring results that documented that the dam removal directly resulted in restoration of the aquatic habitat for Atlantic salmon and improved riparian wetland functional lift and increased wetland extent. The riverine and floodplain habitats were surveyed pre- and post - dam removal annually between 2020-2025. The riverine aquatic habitat was measured through geomorphic surveys, water quality sampling, and Atlantic salmon habitat and spawning surveys. Following dam removal, fish passage was restored to over 54 stream miles for the first time in 240 years and successful spawning of federally endangered Atlantic salmon was documented. Improved temperature, improved dissolved oxygen, and creation of new critical habitat (148 units) in the former impoundment was also recorded. In the wetland and riparian habitats, data on plant species composition and areal cover were collected by meander surveys and along fixed transects with M2 plots using a stratified random technique where each distinct wetland cover type was surveyed. Results informed adaptive management decisions such as invasive species control and supplemental seeding/planting. Within weeks of the dam's removal, wetland succession accelerated rapidly with native wetland vegetation achieving 75-90% cover. Within two years, the area transitioned to a scrub-shrub habitat dominated by native species such as speckled alder and willows.

Primary Author: Daniel Niederberger

Affiliation: California Department of Fish and Wildlife

Title: Co-benefits of Aquatic Passage and Terrestrial Connectivity

Key Words: Terrestrial and Aquatic Connectivity

Abstract:

Habitat fragmentation and aquatic barriers pose significant challenges to wildlife movement and ecosystem health. Improving terrestrial wildlife connectivity and aquatic passage offers complementary strategies to restore ecological integrity and resilience. Both approaches share common benefits, including enhanced biodiversity conservation, climate change adaptation, and improved ecosystems. By facilitating species movement, these efforts maintain genetic diversity, support population recovery, and enable access to critical habitats. Restored connectivity also strengthens ecosystem functions such as nutrient cycling, sediment transport, and water filtration. All contributing to healthier landscapes and waterways.Beyond ecological gains, connectivity projects deliver social and economic benefits. They reduce human-wildlife conflicts, improve public safety by mitigating roadkill, increase flood and wildfire protections and support recreational opportunities such as fishing, wildlife viewing, and ecotourism. Additionally, these initiatives uphold cultural values, particularly for Indigenous communities reliant on fish and wildlife resources.Methods to achieve these benefits include constructing wildlife corridors, overpasses, and underpasses for terrestrial species, and removing or retrofitting barriers such as dams and culverts to restore aquatic passage. Strategic planning integrates habitat restoration, riparian buffer enhancement, and adaptive management to ensure long term success. Collaborative approaches involving state, federal, and local agencies, stakeholders, tribes and communities are essential to maximize ecological and societal outcomes.By highlighting the shared benefits and practical solutions, the importance of connectivity as a cornerstone of modern conservation can be realized. Restoring movement pathways for terrestrial and aquatic species not only safeguards biodiversity but also fosters resilient ecosystems and sustainable human-wildlife coexistence.

Primary Author: Jen Norris

Affiliation: California Wildlife Conservation Board

Title: Accelerating California's 30x30 Progress Reconnecting Rivers and Coastal Waters

Key Words: Fish passage, 30x30, conservation, influence

Abstract:

The global 30x30 movement is mobilizing action at all levels to address climate resilience, biodiversity, and thriving people and landscapes. California is an influential leader in policy, planning, and implementation in the international conservation effort, with its ambitious commitment to conserve 30% of California's lands and coastal waters by 2030. Dr. Norris will provide updates on California's progress toward 30x30 with a focus on the Wildlife Conservation Board's role in supporting fish passage and reconnecting rivers and coastal waters along with its investments in climate adaptation, habitat connectivity, Tribal priorities, and more.

Primary Author: Monica Nova

Affiliation: Sierra Streams Institute

Title: Dry Creek Anadromous Fish Passage Improvements, Habitat Enhancement, and Ecological Monitoring Following 2020 Dam Removal

Key Words: fish passage, salmonid, restoration

Abstract:

Sierra Streams Institute (SSI) presents multiyear fish passage improvement project employing spawning habitat enhancement for anadromous salmonids in Dry Creek, located in Nevada and Yuba Counties, including Chinook salmon (Oncorhynchus tshawytscha) and federally threatened Central Valley steelhead (Oncorhynchus mykiss), coupled with post dam removal restoration and ecological monitoring following the 2020 removal of a 12 ft high dam. Learn about SSI's Dry Creek salmonid spawning gravel augmentation work, both past and upcoming, and hear results from 3 years of post dam removal monitoring including fish surveys, water quality and benthic macroinvertebrate sampling, eDNA analysis, and vegetation surveys. SSI will also share their community science program that connects school students to the post dam removal restoration site, anadromous fish and spawning gravel augmentation, and stream ecology, as well as ongoing work to educate the broader local community about fish passage restoration and the Dry Creek watershed. Remaining fish passage challenges within the Dry Creek watershed, and outlook for additional passage improvements in the future, will also be discussed.

Primary Author: Nathan Nunez

Affiliation: Tribal Advisory Group Representative, California's Fifth Climate Change Assessment, Governor's Office of Land Use and Climate Innovation

Title: Centering Tribal Kinship in California's 30x30 Goals: A Relational Path to Watershed Restoration and Fish Passage

Key Words: Tribal personhood 30x30 fish passage

Abstract:

Across California, tribal nations are re-centering kinship with the living world, restoring a relational path that sustains biodiversity and climate resilience. Rooted in stewardship since time immemorial, this approach is now driving a modern paradigm shift in environmental policy. Bridging this foundational understanding with tangible action is essential for the success of California's 30x30 goals, habitat restoration, and fish passage. To support this momentum, the Tribal Advisory Group of California's Fifth Climate Change Assessment is informing new research initiatives and a robust tribal grant program designed to expand projects that are either already underway or critically needed. Ultimately, recognizing the personhood of our aquatic ecosystems is vital to ensuring that watershed restoration and fish passage meet the enduring needs and values of tribal communities.

Primary Author: Andrew Omalley

Affiliation: Gomez and Sullivan Engineers

Title: Leveraging Refence Reach Methodology to Estimate Delay

Key Words: Delay, survival, passage study

Abstract:

Telemetry studies are used to assess both survival and migratory delay at fish passage barriers. We aim to demonstrate a reference reach approach can be used to better estimate and quantify the delay attributed to various barriers to movement. In Zydlewski et al. 2016, the authors showed that in many scenarios utilizing a single-release and reference reach methodology can reduce bias in estimates of survival in impacted river reaches. We extend this same reference reach methodology to estimate travel time through reaches with and without barriers. This can then be leveraged to estimate the additive transit time in a reach with a barrier. This leads to an estimate of migration delay that is independent of the travel time through the underlying reach and thus is assumed to be attributed to the presence of the barrier. We demonstrate how this can be accomplished several ways by applying different methods to several study datasets, including: 1) A simple correction for a scenario where fish transit both the impact and reference reach; 2) a bootstrapping correction for a scenario where separate samples of fish pass through the impact and reference reach; and 3) a bootstrapping correction for fish that transit multiple reference and impacted reaches in a system-wide study. This provides an estimate of migration delay by a fish passage barrier independent of the background rate of movement.

Primary Author: Danielle Palm

Affiliation: U.S. Geological Survey

Title: The Raft: A new non-intrusive sampling device for observing fish in riverine systems

Key Words: novel survey techniques, equipment design, habitat use

Abstract:

Rigorous study of fish passage faces challenges and seasonal regulatory constraints, such as avoiding spawning season and sensitive habitats, due to many sampling techniques involving heavy fish and habitat disturbance. Minimizing survey impact through different techniques may allow sampling constraints to be relaxed and enable studies that capture new aspects of fish passages. We have developed a new, non-intrusive sampling platform that allows us to collect data on sensitive species and habitats. The platform consists of two pontoons supporting a utility rack that can hold underwater video cameras, water quality sondes, a Global Positioning System, Passive Integrated Transponder (PIT) tag scanners, and sonar units while being directed along the surface of the water. The platform enables us to collect video recordings of fish activity while simultaneously getting real-time habitat characteristics. We've used the platform for investigating potential spawning habitat and activity of threatened Clear Lake Hitch (Lavinia exilicauda chi) in tributaries of Clear Lake, CA, to inform conservation and management. We also used this platform to capture fish presence for ongoing population monitoring of native fish in the Santa Ana River, near Riverside, CA. This poster presents the design of this platform, its utility in fisheries study, and two examples where we've used it for studying native species behavior and presence in migratory corridors.

Primary Author: Marius Panahon

Affiliation: University of Batangas

Title: From Headwaters to Estuaries: Watershed Connectivity and the Bonggan (Juvenile Goby) Fishery in Calapan City, Oriental Mindoro, Philippines

Key Words: Watershed connectivity, juvenile gobies, bonggan fishery

Abstract:

Watershed connectivity is fundamental to sustaining diadromous and amphidromous fish species whose life cycles depend on unobstructed movement between headwaters, sidewaters, and estuaries. In Calapan City, Oriental Mindoro, the local fishery known as bonggan targets juvenile gobies harvested seasonally in the Sinabu–Maidlang river system, particularly during the northeast monsoon (Amihan). This study examines how hydrological connectivity, seasonal flows, and human interventions influence the migration pathways, availability, and sustainability of this small-scale but culturally and economically important fishery.Using a mixed-methods approach, we combined field observations of juvenile goby occurrence along longitudinal river–estuary gradients, key informant interviews with fishers and local fisheries officers, and a rapid assessment of physical and regulatory barriers, including net placement, small-scale structures, and riverbank modifications. Preliminary findings indicate that bonggan availability is closely linked to tidal exchange and freshwater discharge, with peak upstream movement coinciding with Amihan-driven flow pulses. However, obstructions to navigation and poorly regulated fishing gears may disrupt natural movement corridors and concentrate fishing pressure at narrow passage points.The study highlights the role of community-based governance and information, education, and communication (IEC) initiatives in aligning local fishing practices with watershed restoration and connectivity goals. By framing the bonggan fishery within a headwaters-to-estuaries perspective, this research demonstrates how small, juvenile fish species can serve as ecological indicators of functional river–coastal linkages. The findings aim to inform restoration, revitalization, and regulatory strategies that balance livelihood needs with the long-term sustainability of migratory fish populations in tropical watershed systems.

Primary Author: Joachim Pander

Affiliation: Aquatic Systems Biology, Technical University of Munich, Germany

Title: More than just up and down: nature-like fish passes provide key habitat for target species of conservation

Key Words: River restoration, Species conservation, Fish migration, Hydropower

Abstract:

To mitigate the loss of connectivity due to dam and weir constructions in rivers, fish passes are widely implemented as corridors for fish to bypass these obstacles. Fish pass designs range from rather technical solutions to nature-like construction schemes (NLF) that mimic natural rivers, yet the roles of such NLF as habitat and thus beyond their function as migration corridors are still poorly understood. We evaluated NLF in the Danube catchment regarding their roles as fish habitats using active and passive bioindication tools. These methods included bioindication with fish eggs, the usage of larval drift analysis and electrofishing. The biotic data were linked to important abiotic characteristics such as water depth, current speed, substrate composition, deadwood, temperature, pH, O2, electric conductivity, and the availability of pools, riffles, runs, spawning grounds and juvenile habitats. The results clearly revealed that NLFs provide important aquatic habitat for almost all life stages of riverine fish, some being highly protected according to national and international legislation. Most NFL comprised a mosaic of different habitats essential for completing critical life stages such as spawning and juvenile life stages. NLF provided shallow habitats which are scarce in dammed water bodies, and which are important for many riverine species. Consequently, NLF had a high fish species diversity including threatened Chondrostoma nasus, Barbus barbus, Thymallus thymallus and Hucho Hucho. Depending on construction features, NLF also provided habitat for limnophilic species such as Rhodeus amarus or Misgurnus fossilis if they were connected to pond-like structures with low flow current. In conclusion, this study highlights that besides their function for fish migration, important habitat functions of NLF are still underestimated and deserve better consideration in restoration planning.

Primary Author: Shubha Pandit

Affiliation: Yakama Nation Fisheries

Title: Parr vs. Smolt Releases: Implications for Coho Salmon Reintroduction Success

Key Words: Fish Reintroduction, Coho, Yakima River basin

Abstract:

Coho salmon (Oncorhynchus kisutch) in the Yakima River Basin, a major tributary of the Columbia River, were extirpated in the early 1980s. Reintroduction efforts led by the Yakama Nation have since restored adult returns, which peaked at more than 25,000 fish in 2014. One of the main reintroduction strategies involves releasing hatchery fish at different life stages—specifically parr and smolts—across multiple tributaries in the Yakima River Basin. Parr typically overwinter in tributaries and emigrate as smolts the following spring, whereas smolts emigrate shortly after release. We evaluated differences in emigration timing, juvenile survival, and age at return using 11 years of data from 289,515 parr and 80,265 smolts tagged with passive integrated transponders (PIT tags) and released in two subbasins (the Upper Yakima River and the Naches River). The results show that parr generally out-migrated later but migrated more rapidly than smolt-released fish. Survival patterns varied by subbasin and life stage. In the Naches River, juvenile migration survival was higher for smolt releases, while smolt-to-adult return (SAR) rates were higher for parr releases. In contrast, parr released in the Upper Yakima River had higher juvenile out-migration survival but lower SAR than smolt releases. Parr releases tended to return at older ages than smolt releases. Overall, these results demonstrate life-stage- and basin-specific differences in survival and return patterns, suggesting that optimal release strategies for hatchery coho salmon are contingent on site-specific environmental and ecological conditions.

Primary Author: Shubha Pandit

Affiliation: Yakama Nation Fisheries

Title: From Hydraulics to Biology: Live-Fish Testing to Improve Salmonid and lamprey Passage at the Wapato Diversion Dam, Yakima River, WA

Key Words: Wapato, Live fish, mortality

Abstract:

The Wapato Diversion Dam on the lower Yakima River is the largest irrigation diversion in the Yakima Basin and has operated since 1917, diverting about 30% of river flow during peak fish migration season. The lower Yakima River serves as the primary migration corridor for anadromous salmonids, making effective fish passage at the diversion critical. Due to poor fish-passage performance under existing conditions, the diversion is currently being evaluated for reconstruction. A headworks sectional model was evaluated across multiple scenarios or treatments that varied river flow, head differential, and tailwater control to identify optimal structural and operational configurations. Live-fish testing was conducted in a physical model constructed by Northwest Hydraulic Consultants (NHC) in Seattle, Washington. Approximately 100 juvenile hatchery fall chinook were released under each of 16 treatment scenarios last summer 2025. Fish injuries (abrasion, descaling, eye hemorrhage, etc.) and mortality were assessed immediately following the experiment and after a 48-hour holding period to evaluate both immediate and delayed effects. Injury prevalence, total injury scores, and mortality rates were estimated for each treatment. Abrasion was the most frequently observed injury, occurring in 15 of the 16 treatments, while descaling occurred in 7 treatments. Mortality was observed in 11 treatments and was primarily associated with design scenarios that produced high-energy hydraulic conditions. The highest mortality rate (12.1%) occurred under a split-leaf headgate configuration with narrow gate openings and a high head differential. In contrast, wide gate openings combined with moderate canal flows produced stable, low-velocity conditions with minimal injury and no observed mortality. These results, together with Sensor Fish and Computational Fluid Dynamics (CFD) modeling, provide guidance for identifying headgate designs and operational strategies that improve fish-passage performance while meeting irrigation requirements.

Primary Author: Molly Payne Wynne

Affiliation: The Nature Conservancy

Title: Developing a Science Approach for the Kennebec River Restoration Project

Key Words: Restoration, monitoring, science, community

Abstract:

For millennia, the Kennebec River, Maine, USA, supported vast migrations of sea-run fish, providing vital connection between the Gulf of Maine and inland freshwater ecosystems, and sustaining Indigenous lifeways. While three centuries of dam construction in New England has left many mainstem rivers, including the Kennebec, highly fragmented, the watershed continues to offer immense potential for recovery of endangered Atlantic salmon and other native sea-run fisheries. In September 2025, The Nature Conservancy and Brookfield Renewable Partners signed a landmark agreement for the purchase of the four lower Kennebec dams by a new non-profit, the Kennebec River Restoration Trust. The Trust was formed to oversee operations of the hydroelectric facilities and manage a multi-year restoration and redevelopment process in close collaboration with local communities. The goal of the project is to restore free-flowing conditions to over 800 miles of river and stream habitat while strengthening the economic vitality of the region. In this talk we will share a brief history and current update on the status of the Kennebec river restoration efforts and spotlight the collaborative process underway in developing a science approach. Our vision is that this science approach will ensure robust scientific understanding including multiple ways of knowing, local engagement, and community science input, to guide restoration actions and implementation for a project that will join the largest river restoration efforts in the nation.

Primary Author: Armin Peter

Affiliation: FishConsulting GmbH, Olten, Switzerland

Title: Biological effectiveness monitoring of a hydropower plant, facilitating fish passage between Lake Zurich and the Limmat River, Switzerland

Key Words: approaching behaviour, attraction of fishpass, radiotelemetrty

Abstract:

The fish passage facility at the Letten hydropower plant in Zurich is the uppermost power plant on the River Limmat, located 2.5 km downstream of the lake outlet. The objective of the study was to determine whether target species are able to locate, enter, and successfully pass the fish migration facility in the upstream direction. Biological monitoring focused on typical target species of the barbel–grayling zone.To assess approaching, searching, and passage behaviour, a combination of three monitoring methods was used: recording fish ascents in a counting basin, a PIT-tagging study, and a radiotelemetry study. Radiotelemetry made it possible to determine the residence time of fish in front of the power plant and to observe which areas they used in this zone. It also allowed assessment of the proportion of fish that approached the power plant and how close they came to the entrance of the fish passage facility. In addition, the time intervals were recorded from first arrival at the power plant to entering the attraction flow area in front of the fish pass, and from there to enter into the fish passage facility itself. Overall, radiotelemetry enabled detailed documentation of fish behaviour in the forebay area.The redetection rate in the PIT-tagging study was 47.4%. The redetection rate for all fish tagged with radio transmitters was 84%. Of the detected fish, 49-65% entered the attraction flow area downstream of the fish pass entrance. However, only 68% of these fish were subsequently detected at the entrance to the fish pass itself. For a facility located at such an ecologically important site, these results must be considered critically. The tailrace area created a migration bottleneck for upstream moving fish caused by the considerable distance between the turbines and the fish pass entrance.

Primary Author: Andrew Peters

Affiliation: River Connectivity Systems

Title: Application of biofouling resistant coatings/flexible barriers

Key Words: Selective Withdrawal Biofouling Control Reservoir Stratification Fish Habitat Restoration

Abstract:

Thermal stratification in large reservoirs creates vertically layered temperature, dissolved-oxygen, and other biogeochemical conditions that, when released downstream, can alter habitat suitability and increase invasive species risk. These altered releases can increase environmental compliance risk and constrain hydropower operations, particularly at sites where intake structures limit control over withdrawal depth. Selective withdrawal provides a means to restore operational control by enabling operators to access and release water from targeted reservoir depths, allowing temperature, dissolved-oxygen, and related water-quality objectives to be met while maintaining hydropower generation. Conventional selective-withdrawal structures—such as fixed or gated intakes—while generally effective, have proven costly, inflexible, and difficult to retrofit, limiting their applicability at existing dams and reservoirs.Flexible curtain-style selective-withdrawal systems offer a low-cost, modular, and retrofit-compatible alternative by enabling control of the vertical withdrawal layer without modifying existing outlet works. A critical challenge to the performance and reliability of these systems, however, is biofouling and the operations and maintenance required to control it. Invasive mussels and associated biofilms increase surface roughness, hydraulic resistance, pressure losses, and structural loads, driving higher capital and O&M costs and reducing long-term effectiveness. Biofouling-resistant surface coatings applied to flexible materials address this constraint by enabling selective-withdrawal systems to function as intended over their service life. This presentation will introduce flexible curtain-style selective-withdrawal systems and the application of biofouling-resistant surface coatings as an enabling technology that makes these systems viable at scale. It will illustrate how effective fouling control preserves hydraulic performance, limits load growth, and reduces operations and maintenance requirements—thereby making modular, low-cost selective withdrawal feasible at existing dams. Visualization support developed with Pacific Northwest National Laboratory will be used to depict reservoir stratification, selective-withdrawal behavior, and fouling impacts, along with updates from ongoing site-specific biofouling studies and current evaluation efforts with U.S. Bureau of Reclamation to inform deployment feasibility and operational decision-making at large, stratified reservoirs.

Primary Author: Jeff Peters

Affiliation: ICF Environmental

Title: A Hydraulic Design Approach for Fish Passage in the Central California Coast: Challenges, Opportunities, and a Boulder Football Field in an "Upside Down Watershed"

Key Words: hydraulic design, roughened channel, southern California steelhead, connectivity

Abstract:

Salsipuedes Creek (Santa Barbara County, California) is designated as critical habitat for federally endangered Southern California steelhead (Oncorhynchus mykiss). To address a significant fish passage impediment under an aging bridge structure on the creek, Caltrans constructed a rock ramp/roughened channel design with a 2.0% slope. Construction was completed in 2020, with the end product constituting one of the largest constructed roughened channel segments in California at more than 300 feet long – the length of a football field. Caltrans replaced the existing three-span bridge structure with a full-span bridge, alleviating scour concerns. The design addressed fish passage constraints and improved lateral and longitudinal continuity of the channel and banks. However, the design approach for Salsipuedes Creek, which occurs at a geologic transition within the watershed and where no appropriate reference reaches were available, necessitated that a hydraulic design approach be undertaken. Unlike a stream simulation design approach, the hydraulic design approach involves designing a structure for passage of targeted fish species and life stages by establishing a stable channel that is compatible with the swimming and leaping abilities of fish over a specified range of flows. Using very large rocks and buried concrete weirs as the underlying framework for the roughened channel (D84 = 4.5 feet!), we designed a rock ramp that created sufficient flow depth and velocity, as well as habitat diversity, to ensure that fish passage conditions would be met over a range of flows.Our presentation focuses on the evolution of the design process and channel responses over five years of monitoring results for channel stability and fish passage conditions, as well as wildlife usage. The channel has adjusted to high flow events and beaver activity over time. The lessons learned from the monitoring effort provide valuable insights for all restoration practitioners working in challenging geological transitional environments.

Primary Author: Jeff Peters

Affiliation: ICF Environmental

Title: North Fork Feather River Reintroduction Feasibility Study: Salmonid Habitat Evaluation in the Shadow of Lassen Peak

Key Words: spring-run Chinook Salmon, geomorphology, habitat suitability model, carrying capacity

Abstract:

Given the worrisome state of spring-run Chinook Salmon in California, the need has increased to explore and potentially implement new means to provide access to historic high-quality habitat above large rim dams. Successful reintroduction could greatly expand existing management options to increase natural production, diversity, and resiliency of Central Calley spring-run, particularly in the Feather River basin. In 2023, the Department of Water Resources (DWR) began a study to determine the potential of reintroducing spring-run Chinook Salmon into historic habitat in the North Fork Feather River Above Lake Almanor. This presentation summarizes the study's habitat assessment component, which was completed via a rigorous hydrogeomorphic-based habitat assessment and 2-D habitat suitability model. Habitat data collection began in 2024 to determine whether sufficient high quality habitat is available for salmonid use in the North Fork Feather River above Lake Almanor. The watershed was divided into roughly 40 valley segments (distinctive sections of the valley network that possess geomorphic properties and hydrologic transport characteristics that distinguish them from adjacent areas). A field reconnaissance and mapping effort of approximately 70 percent of the watershed was conducted within these valley segments, in which each spawning gravel location and holding pool location were mapped, along with areas that possess abundant rearing opportunities. The following year, sub-reaches within valley segments were chosen at random for further field investigation. Along with bioassessment surveys, water temperature, and streamflow data, results suggest that (1) there is a sufficient hydrologic regime to support reintroduction; (2) existing conditions sustain a cold-water temperature regime (between 5 and 9 °C) that can support spring-run Chinook Salmon; (3) most sub-reaches are capable of supporting juveniles from an available food production standpoint; and (4) modeling indicates that there is ample physical habitat to support a large run of adult salmon and abundant juvenile production.

Primary Author: Marcela Politano

Affiliation: certainFlow LLC

Title: Field and Modeling Study of Total Dissolved Gas to Support Habitat Quality at Sinop Dam

Key Words: TDG, water quality, numerical modeling, field study

Abstract:

Elevated total dissolved gas (TDG) poses a significant threat to aquatic organisms, potentially leading to gas bubble disease (GBD). The severity of GBD depends on various factors, including the fish species, age, supersaturation levels, and exposure duration. In the past, fish exhibiting GBD symptoms have been observed on the Teles Pires River in Brazil during spillway releases, when plunging jets entrain air bubbles that dissolve under pressure in the tailrace. TDG can significantly reduce the effectiveness of fish passage and survival downstream of dams.TDG uptake in Sinop Dam is mitigated by gradually spillway gate operations. While this approach has been effective to avoid GBD, this strategy limits the ability to perform immediate spill if necessary. To further reduce the risk of supersaturation and enhance dam operation flexibility, spillway flow deflectors that redirect the plunging flow horizontally are being evaluated. This study presents a comprehensive field data campaign, analysis of historical TDG records from permanent monitoring probes, and a validated three-phase flow model developed with the open-source code OpenFOAM to evaluate TDG distribution in the Sinop Dam tailrace. The model represents air, water, and dispersed bubbles as separate phases and includes both a bubble dissolution module and an air-entrainment formulation specifically developed for spillway flows. Model performance was assessed against pressure measurements from a 1:100 scale hydraulic model under 10- and 100-year flood conditions, as well as TDG field data collected downstream of the dam. The presentation will discuss field measurement challenges, numerical modeling approaches, deflector design criteria, and predicted TDG levels with and without the proposed deflectors.

Primary Author: Marcela Politano

Affiliation: certainFlow LLC

Title: Numerical investigations of supersaturated water transport downstream of a Norwegian hydropower plant

Key Words: TDG, numerical modeling, water quality

Abstract:

When total dissolved gas (TDG) levels exceed 100% at atmospheric pressure, river waters become supersaturated. While such conditions are rare in natural systems, human activities, particularly hydropower operations, can generate elevated TDG levels downstream of dams. TDG supersaturation negatively affects aquatic organisms, especially fish, by causing physiological stress, increasing mortality risk, and creating barriers to migration that can effectively fragment riverine habitats.The Norwegian DeGas project was an interdisciplinary effort aimed at mitigating TDG supersaturation caused by spill operations at the Brokke hydropower plant on the Otra River in southern Norway. This two, and three-dimensional numerical modelling approaches for simulating TDG dynamics downstream of the Brokke plant, with the objective of evaluating their capabilities, limitations, and applicability for TDG assessment and mitigation planning.The two-dimensional approach combines hydrodynamic simulations using HEC-RAS 2D with a finite-difference formulation for TDG transport, allowing resolution of lateral mixing processes. The three-dimensional model was developed using the open-source platform OpenFOAM. A scalar transport equation for TDG was implemented in the pimpleFOAM solver. This approach resolves detailed flow structures and gas exchange processes with minimal empirical calibration, enabling improved estimation of vertical TDG gradients and surface degassing.Cross-model comparisons enhanced confidence in the results, particularly under field data-scarce conditions. The presentation will discuss model formulations, calibration strategies, numerical methods, and comparative results, highlighting how multi-dimensional modelling can support TDG mitigation strategies and improve fish passage outcomes downstream of hydropower facilities.

Primary Author: Samuel Prentice

Affiliation: GEI Consultants

Title: Republic Dam Fish Passable Rock Rapids Construction

Key Words: fish passage hydraulics, design

Abstract:

In 2024, GEI modified an existing dam through design and construction of a fish-passable rock rapids. This constructed rapids spans the entire width of the river and its floodplain, with a vertical drop of nearly 15 feet along its 650-foot length, allowing the owner to maintain a similar minimum water surface to the former dam and meet regulatory fish passage requirements. Volitional fish passage for cold and warmwater species has been demonstrated on similar nature-like fishways throughout the Midwest, most notable by Dr. Luther Aadland, using a series of boulders, gaps, and resting pools that emulate natural river processes. This is the first design of its kind to be constructed in Michigan, with notable differences to other previously constructed rapids in Michigan with varied fish passage success. This presentation will share the design approach used for this project including considerations for burst speeds of different warmwater fish species, accommodating these speeds through various gap depths and widths in between grade-controlling boulders, and pool depth in between grade-controlling boulders to allow for resting within the constructed rapids. In addition to design criteria, this presentation will share several construction photos and videos showing the progression of work and different constructability considerations throughout the 2024 field season. To conclude, the project team will also share photos of the freshwater mussel survey performed prior to construction and underwater video of fish passage success to date.

Primary Author: Meghan Quinn

Affiliation: Massachusetts Department of Fish and Game, Division of Ecological Restoration

Title: Don’t only dream big: Advancing small, simple dam removal projects isn’t just opportunistic, it’s strategic

Key Words: Dam removal, river restoration, dam removal prioritization, project portfolio

Abstract:

Many tools and methods have been developed for identifying and prioritizing the best and most impactful dam removal projects. While it may be tempting to simply start at the top of the list and work your way down that may not be the best strategy to achieve the largest impact for ecosystems or people. The capacity, skillset and goals of the organization advancing those projects is an important and often overlooked consideration when building a portfolio of dam removal projects. While the big, impactful projects deliver the biggest outcomes and headlines, these can often take decades to accomplish, leaving organizations and their staff feeling burned out, disheartened and lost in the complexity. The small wins - the ones that may not appear to achieve widespread impact, but that could make for easy successes, projects that might be called “opportunistic” - should not be discounted. They can be strategic. They give organizations the opportunity to learn and achieve success in a short time frame; so they’re better equipped to take on, and stay motivated for, the complex ones. Enabling the people and organizations advancing these projects to thrive and grow creates the conditions for the rivers to thrive too. These projects also give the community a demonstration of success, building the public’s understanding and comfort with dam removal. When social pushback is often the most difficult part of a dam removal project, this can be invaluable. This talk is presented by a project manager at the Massachusetts Division of Ecological Restoration (DER), who speaks from experiences of frustration and success, sharing examples of completed and hopeful-to-be-completed projects and lessons learned from DER’s dam removal program in Massachusetts, USA. While it may sound counterintuitive, taking on more dam removal projects, but simple ones, could be the key to tackling the big ones.

Primary Author: Jean Quirion

Affiliation: Innovasea

Title: Monitoring and Effectiveness Testing for Fish Passage Projects

Key Words: Fish monitoring, fish counting, species identification

Abstract:

Assessing fish passage efficiency is essential for evaluating the effectiveness of fishways and other mitigation measures designed to restore longitudinal connectivity in aquatic systems. Among the primary methods used to quantify fish passage efficiency are human manual counting, video-based monitoring systems, and acoustic telemetry. This presentation provides an overview of these approaches, highlighting their respective strengths, limitations, and practical applications in fisheries research and management.Human manual counting has historically served as a benchmark for fish passage assessments due to its ability to capture detailed information on species identification, size, and behavior. However, this method is labor-intensive, costly, and susceptible to observer fatigue and bias, particularly during peak migration periods. Video monitoring systems offer an alternative by enabling continuous observation and permanent data records. Recent advances in artificial intelligence (AI) have further enhanced video analysis by automating fish detection, counting, and species classification, reducing processing time while increasing scalability.Acoustic telemetry represents another powerful tool for evaluating passage efficiency by tracking the movements of individually tagged fish through passage structures and surrounding habitats. This method provides high-resolution data on movement pathways, passage success rates, delays, and fallback behavior, but it is limited by tagging costs, sample size constraints, and infrastructure requirements.The presentation discusses the challenges and opportunities associated with each method, including environmental influences on detection accuracy, technological limitations, and emerging innovations. Several case studies are presented to demonstrate real-world applications of manual counting, video and AI-based monitoring, and acoustic telemetry, illustrating how these complementary approaches can be integrated to improve fish passage efficiency assessments and inform management decisions.

Primary Author: Jean Quirion

Affiliation: Innovasea

Title: Beyond Enumeration: Advancing Real-Time Species Classification and American Eel Monitoring in Fish Passages with HydroAI

Key Words: Real-time Fish Monitoring, Species Classification, Artificial Intelligence, Hydropower, American Eel (Anguilla rostrata)

Abstract:

Effective fish monitoring at hydropower facilities is essential for balancing renewable energy production with aquatic ecosystem stewardship. HydroAI, a fully automated AI-driven monitoring system, is currently operational across diverse hydraulic environments in Canada, providing real-time, high-certainty fish passage data. While early deployments focused primarily on high-accuracy enumeration—counting over 2.2 million fish with a validated margin of error of 2.6% in recent deployments—this presentation details two distinct, significant evolutions of the platform: the integration of robust, real-time species classification, and the deployment of specialized computer vision capabilities designed to monitor and size American eels (Anguilla rostrata), a critical species of conservation concern.First, we present validation results for our advanced deep learning classification models, which distinguish between diverse species in complex underwater environments. These capabilities allow operators to transition from aggregate counts to species-specific biodiversity monitoring. Second, we discuss the 2026 expansion of the HydroAI network to new sites specifically targeting American eel migration. Monitoring this species presents unique challenges due to their morphology and behavior. We will share operational insights demonstrating how the system's biometric sizing and hybrid edge-cloud architecture are being adapted to support the conservation of this threatened catadromous species.

Primary Author: Maggie Raboin

Affiliation: U.S. Geological Survey

Title: Non-physical barrier design and environmental conditions alter routing and survival of juvenile Chinook salmon (Oncorhynchus tshawytscha) in the Sacramento-San Joaquin River Delta

Key Words: BioAcoustic Fish Fence

Abstract:

Pacific salmon face substantial challenges when migrating through anthropogenically modified river systems, such as the Sacramento-San Joaquin River Delta (the Delta). Non-physical behavioral barriers, such as the BioAcoustic Fish Fence (BAFF), are one solution for guiding fish away from hazards without obstructing water flow. However, the effectiveness of these technologies depends on factors like barrier design, environmental conditions, and fish behavior. In the Delta, a BAFF was deployed at Georgiana Slough in 2011, 2012, and 2024 to deter juvenile Chinook salmon (Oncorhynchus tshawytscha) from migrating into the interior Delta, a region associated with low survival. We leveraged nearly two decades of acoustic telemetry data to evaluate BAFF performance across flow conditions and two BAFF designs (2011/2012 vs 2024), and to assess the BAFF's contribution to improving through-Delta survival. The BAFF reduced routing into Georgiana Slough from 26.5% without a barrier to 8.9% in 2011/2012 and 15.9% in 2024. In general, routing into Georgiana Slough increased with the proportion of flow entering the channel during periods without a BAFF and during the 2024 deployment but remained constant during the 2011/2012 deployment. Additionally, BAFF effectiveness declined with increasing input flow. Ultimately, reduced routing into Georgiana Slough during the 2024 BAFF deployment resulted in an increase in estimated through-Delta survival between 0.2 to 1.6 percentage points depending on release group. Our results provide valuable insights into the role of non-physical barriers in complex river systems and inform future management strategies for protecting migrating juvenile Chinook salmon in the Sacramento River Basin.

Primary Author: Jenna Rackovan

Affiliation: Verdantas

Title: Field Evaluation of the FishHeart Hydraulic Fishway for Passing Fish Upstream at Hydropower Dams

Key Words: fish passage, telemetry, River herring, American Shad

Abstract:

The Fishheart Hydraulic Fishway (Fishheart), a new technology developed in Finland, has potential for application in the U.S. to effectively pass diadromous and resident fishes upstream at hydropower dams. The Fishheart has been accepted for upstream passage of salmonids in Finland but there has been limited testing with migratory fishes in the USA. The Fishheart could be a major advancement in state-of-the-art upstream fish passage, especially at locations where use of traditional fish passage technologies would be difficult. The Fishheart is a floating unit, designed to be installed on the downstream side of a dam. The Fishheart runs on either siphoned or pumped water to provide an attraction water spray and inner attraction flow, guiding the fish into the system. Once the fish swim inside one of the passage conduits, the Artificial Intelligence (AI)-driven camera system recognizes the species and their size and then, based on given orders, passage is initiated and fish are transported upstream. A field study at Santee Cooper's Santee Dam and Spillway hydropower project in South Carolina was conducted to determine the ability of the Fishheart to safely and effectively pass American Shad (Alosa sapidissima) upstream in a timely manner. Behavior of American Shad in the vicinity to the Fishheart were monitored with acoustic telemetry. Passage of resident freshwater fish were also monitored during this field study given that the technology may also have application to dams where anadromous fish are not present. This presentation will provide a review of the laboratory and field evaluations conducted as well as identify additional study needs to demonstrate effectiveness with Pacific Anadromous species.

Primary Author: LI Ran

Affiliation: State key laboratory of hydraulics and mountain river engineering, Sichuan University

Title: Research challenges about TDG supersaturation impact on fishes in the changing circumstances

Key Words: Total dissolved gas, supersaturation, mitigation, dam discharge

Abstract:

Dam spill of Hydropower projects results in supersaturation of total dissolved gas (TDG), which may cause gas bubble disease (GBD) or even mortality of fishes. Now a series of new challenges has appeared for TDG supersaturation problem. First, high dam spill with high water head and large discharge rate, leads to TDG supersaturation particularly prominent. Moreover, rare and endemic fish species in dam-constructed rivers makes the impact especially sensitive. Therefore, various mitigation technologies suitable for high-head dams have emerged in recent years. Second, the cumulative impact of TDG supersaturation caused by consecutive cascade development has become increasingly prominent. Although cascade operation reduces the probability of flood discharge and thus alleviates the risk of TDG supersaturation affecting fishes to some extent, the cumulative impact of hydropower project discharges has become more complex and prominent. As a result, cascades joint scheduling based on TDG supersaturation has become an inevitable requirement. Third, as more and more hydropower projects are developed to upstream sections of rivers and high altitudes regions, conditions such as low atmospheric pressure and large daily temperature differences lead to specific impacts of TDG supersaturation on plateau fishes. Research on mitigation technologies based on the tolerance of plateau fish has become a new hot spot. Fourth, extreme meteorological conditions and heavy rainfall have led to the occurrence of extreme flood discharge, making the situation for TDG supersaturation risk prevention and control more severe, and putting higher demands on fast prediction and warning technology. In addition, the lack of guiding standards for fish tolerance thresholds and the design of mitigation measures is also an important bottleneck restricting the research on TDG supersaturation problem.

Primary Author: Kevik Rensink

Affiliation: Puget Sound Energy

Title: Puget Sound Energy's Fish Passage Facility Operation and Maintenance on the Baker River Project in Concrete, WA – An Owner's Perspective

Key Words: Passage, Facilities, Operations, Maintenance

Abstract:

As part of their relicense in 2008, Puget Sound Energy designed, constructed, and commissioned a new fish passage facility, including a new hatchery, two floating surface collectors, and an upstream fish trap. This is when the real work of operating the facility and determining its effectiveness began. While some fishways may be relatively simple and require insignificant levels of operations and maintenance effort, our fishways are large and complex with many moving parts, mechanical systems, electrical systems, automated controls, instrumentation, and monitoring technologies requiring teams of O&M staff representing significant investments of time and money. We own and operate two dams on the Baker River, and each site is hydraulically and biologically unique. The first floating surface collector was installed in 2008 on Baker Lake, the upstream fish trap was constructed in 2010, the floating surface collector on Lake Shannon was completed in 2012, and the new Baker Hatchery was finished in 2011. There was a significant biological monitoring program requirement for the initial few passage seasons to document effectiveness, and based on the results of these studies, decisions were made concerning potential alterations to the operating procedures and/or physical modifications to the facilities. These adaptive management decisions have ranged from relatively minor adjustments to significant modifications. This session will highlight the success of our fish passage facilities, as well as speak to the experiences of operating and maintaining the new fish passage facilities, including staffing needs, lessons learned, and necessary modifications along the way.

Primary Author: Ruben Rocha

Affiliation: McMillen

Title: Barrier Removal in Europe: Drivers, Outcomes, and Lessons for River Restoration

Key Words: Sustainability, River Restoration, Biodiversity, Ecological Connectivity

Abstract:

As river restoration gains momentum across Europe, obsolete barrier removal is emerging as a leading strategy to reverse decades of river fragmentation, restore ecological function, and improve climate resilience. Drawing on 77 documented case studies on the Dam Removal Europe, from 15 European countries, we analyzed the key drivers of barrier removal and the ecological or socio-economic impacts observed or anticipated post-removal. The analysis shows that ecological motivations, especially restoring fish migration and sediment transport, are the primary catalysts for action. Other major drivers include safety concerns related to aging or failing infrastructure, and economic factors such as high maintenance costs for obsolete structures. Challenges encountered during removal projects often reflect local complexities, such as sediment management, erosion control, heritage preservation, social opposition, and the presence of invasive species. Barriers removed ranged from culverts and fords to large dams, with impacts tailored to site-specific conditions. Notable benefits reported include the reconnection of river segments, reduced flood risks, lower long-term maintenance liabilities, and biodiversity gains, particularly for migratory fish species. For example, projects like those in Finland, Spain, and France have opened new habitats and restored dynamic river processes, contributing to national and EU-wide conservation goals. The findings underline the importance of multi-stakeholder coordination and early identification of both ecological opportunities and implementation challenges. These European cases provide valuable lessons for aligning dam removal with river basin planning, biodiversity strategies, and climate adaptation. As countries move to meet the EU Biodiversity Strategy's target of restoring 25,000 km of rivers by 2030, these case studies show how targeted, well-managed removals can deliver high returns for nature and society.

Primary Author: Richard Roos-Collins

Affiliation: Water and Power Law Group PC

Title: Risk Management in Klamath Dam Removal

Key Words: dam removal

Abstract:

Successful dam removal requires risk management. Things can go wrong, including adverse ecosystem impacts, cost overruns, schedule delays, and damages to third parties. In undertaking the largest dam removal in history, the Klamath River Renewal Corporation used a systematic risk management approach. It is the single point of accountability for performance, shielding its co-licensees, States of California and Oregon. It used progressive design-build procurement contracts to allocate risks between contractors and owner. It holds a comprehensive insurance program covering all insurable events, including damages caused by sediment transport from the lowermost dam site > 190 miles to the Pacific Ocean. And this insurance program is backstopped with bonds and a settlement fund. In sum, systematic risk management contributes to successful dam removal, on time and budget. The presenter, Richard Roos-Collins, is General Counsel for the Klamath River Renewal Corporation.

Primary Author: Megan Ruby

Affiliation: Michigan State University

Title: How migrating sea lampreys ascend eel ladders: effects of environment and perception of predation risk on route preference and ramp performance

Key Words: selective fish passage, swimming behavior, invasive species management

Abstract:

Migrating sea lampreys (Petromyzon marinus) can climb eel ladders, studded ramps with flowing water, to ascend dams. Depending on where it leads, eel ladders can be used to capture invasive sea lampreys in the Great Lakes, or pass them upstream throughout their native range. In the Great Lakes, a proposed selective fish passage device uses a conspecific alarm cue to guide sea lampreys towards an eel-ladder equipped trap. A recent study showed that exposing sea lampreys to the alarm cue reduces the number that were captured. Moreover, several studies have shown highly variable success rates in ascending eel ladders. Using field video of 183 sea lampreys ascending eel ladders, we examined their movement paths for evidence (1) of preferred or more successful routes of ascension, and (2) whether prior exposure to the alarm cue affected their path selection and/or climbing performance. We developed generalized linear models relating several passage metrics (climbing duration, path (e.g., side vs. center of the ramp), number of turns and attachments) and environmental variables (time of day, water temperature, Julian date) to presence or absence of the alarm. We also examined preference for use of the sides vs. center of the ramp as a function of height on the ramp. We will discuss the implications of our findings for improving eel ladder ramp designs and deployment practices.

Primary Author: Denis Ruttenberg

Affiliation: Santa Clara Valley Water District

Title: ASCE/AFS Joint Committee on Fisheries Engineering and Science – Providing a nexus between aquatic restoration efforts and the wider engineering community

Key Words: Resources, networking, webinars, conferences

Abstract:

Infrastructure projects at or near a waterway frequently involve elements of fish/aquatic organism passage and/or riparian or floodplain habitat (e.g road/stream crossings, channel stabilizations, hydropower/diversion structures). This biological aquatic element often requires a multi-disciplinary team to expeditiously achieve multiple objectives for projects. Often there is lack of recognition or insufficient understanding of the intricacies of the biological component of a civil engineering project in a waterway. Where do we find a common ground and common language for engineers and biologists? Since 2012, the EWRI Fisheries Engineering Committee or the ASCE-EWRI/AFS-BES Joint Committee has served to connect engineers to biologists and geomorphologists for successful collaboration on complex instream restoration projects. The Joint Committee is a team of experienced professionals that develops collections of free resources to bring project staff, project components, and design elements together for a successful multi-disciplinary project, as well as furthering research in this field. This presentation will discuss various task groups, products, and projects of the Joint Committee, including a free webinar series, specialized annual conferences, project and career awards, trainings, fish passage databases, and literature products. These products enable designers and managers to quickly access the information and assemble a team to navigate a project in this specialized field. The presentation will also include examples of how these resources can be accessed to implement a fish passage or riparian restoration project.

Primary Author: Sarah Ryan

Affiliation: Big Valley Band of Pomo Indians

Title: Not On Our Watch: California Tribes' Actions To Save An Aquatic Species

Key Words: multi-jurisdictional management, Tribal engagement

Abstract:

The Clear Lake Hitch—known as Chi to local Tribes—was listed as a threatened species by the California Department of Fish and Wildlife in 2014. By 2022, juvenile recruitment failure had reduced the population dramatically, with fewer than ten fish observed by USGS during studies on Clear Lake. In response to this critical decline, the Big Valley Band of Pomo Indians mobilized neighboring Tribes to speak at the August 2022 Fish and Game Commission Tribal meeting. There, Tribal Elders delivered a powerful message to the Commission: “We will not let another species go extinct on our watch.”Following that meeting, Tribes joined forces with multiple state agencies to form the Clear Lake Hitch Task Force—a government-to-government partnership dedicated to identifying the factors threatening the Chi and taking concrete action to ensure its survival. This collaborative work has included instream flow studies, evaluations of groundwater and surface water interactions, issuance of Emergency Information Orders by the State, heightened enforcement of illegal water diversions, extensive fish monitoring and rescues of tens of thousands of juvenile Chi, local training in flow measurement, and four Hitch Summits uniting State, Tribal, and local leaders.This session will highlight how Tribal scientific monitoring, grounded in Tribal sovereignty and cultural knowledge, fostered a multi-agency, multi-jurisdictional collaboration to protect the Chi—and will share lessons learned from the Tribal perspective.

Primary Author: Owen Ryerson

Affiliation: University of Massachusetts Amherst

Title: Novel East Coast Ladder design shows improved passage for American Shad (Alosa sapidissima) and Sea Lamprey (Petromyzon marinus)

Key Words: Fishway design, hydraulics

Abstract:

We present a novel baffle fish ladder design, the East Coast Ladder (ECL), that is tailored to the swimming abilities of multiple East Coast fish species. We propose the ECL as a potential replacement for the ubiquitous Denil ladder, the most common type of volitional fishway in the Northeast United States. The Denil ladder was designed decades ago for salmonids and remains standard in the eastern United States despite substantial evidence showing reduced passage performance for many non-salmonid species. The new ECL consists of wall-mounted vertical quarter-cylinder baffles designed to reduce velocities. Unlike the Denil ladder, where velocities increase significantly with flow depth, velocities in the ECL remain constant as depth increases due to the vertically uniform design. To evaluate the ECL design, flume experiments were conducted with American Shad (Alosa sapidissima, n = 278) and Sea Lamprey (Petromyzon marinus, n = 144) in both ECL and Denil ladders. Passage trials were conducted in the USGS Eastern Ecological Science Center S.O. Conte Research Laboratory’s large open-channel flume during the 2025 migration season. Shad and Lamprey were collected from the Connecticut River and used as subjects in volitional entry ECL and Denil ladder trials under varying flow depths and river temperatures. Cox proportional-hazards models were used to assess passage efficiency. Both Shad and Lamprey show significant passage efficiency gains in the ECL compared to the Denil ladder across flow depth and temperature conditions. The most substantial improvements were observed in Shad, where the ECL significantly outperformed the Denil ladder in total passage success. In addition, to our knowledge this study provides the first data on passage efficiency of Lamprey in Denil ladders.

Primary Author: Aljon Salalila

Affiliation: Pacific Northwest National Laboratory

Title: Fish Passage Evaluation in a Sectional Physical Model of a Low-Head Diversion Dam

Key Words: Fish passage, Low-head diversion dam, Physical modeling, Hydraulic injury risk

Abstract:

Restoring safe and effective fish passage at low-head diversion dams remains a critical challenge in regulated river systems. These structures are widely distributed, primarily designed for irrigation or water supply, and often generate shallow, high-velocity, and turbulent flow conditions that can increase injury risk for migrating fish. Because low-head diversion dams frequently interrupt upstream and downstream fish movement, improving passage performance at these facilities is essential for supporting fish recovery and river management. This study evaluates fish passage conditions at the Wapato Diversion Dam in Washington, a major irrigation diversion on the Yakima River. Hydraulic conditions were evaluated using Sensor Fish Mini (SF Mini) technology in a 1:4-scale sectional physical model of the diversion dam. The SF Mini is a neutrally buoyant sensor that records acceleration, pressure, and rotational velocity, enabling quantitative assessment of hydraulic stressors associated with fish injury risk. Testing was conducted across existing and proposed undershot and split-leaf gate configurations, with and without tailwater control. Data were analyzed using the Hydropower Biological Evaluation Toolset (HBET) to identify severe acceleration events and to compute a velocity-based strike metric (Mv) related to fish survival probability. Results show that the existing undershot configuration without tailwater control produced the highest rate of severe acceleration events (68.6%), whereas all proposed configurations exhibited substantially lower rates, ranging from 38.3% to 44.3%. Proposed designs therefore reduced severe acceleration exposure by approximately 24–30 percentage points. Velocity-based strike metrics further indicated that the existing configuration produced higher strike severity, while all proposed configurations exhibited lower and statistically similar Mv distributions. Statistical testing confirmed significant differences between the existing and proposed designs for Mv ($p < 0.05$). These results support design and rehabilitation decisions for low-head diversion dams by identifying passage configurations that reduce hydraulic injury risk and improve passage performance.

Primary Author: Christian Schlautmann

Affiliation: Department of Aquatic Ecology, Faculty for Biology, University of Duisburg-Essen, Germany

Title: From abiotic triggers to thermal spawning guilds: A meta-analysis of European freshwater fish spawning migration

Key Words: Abiotic drivers, Connectivity, Environmental cues, Life-history traits

Abstract:

Fish spawning migration within river networks is a key element of freshwater fish life cycles, enabling access to suitable spawning habitats and ensuring population persistence. Yet more than one million barriers disrupt longitudinal connectivity in European rivers, creating conflicts between ecological integrity and human uses. A critical requirement for improving fish passage and barrier operation is the robust understanding of abiotic drivers that initiate and shape spawning migrations. Knowing these triggers will help to anticipate migration periods and support targeted management actions, such as adapting turbine operation or timing the operation of fish passage facilities. However, existing knowledge on environmental migration cues is limited, species-specific, and often focused on a small number of well-studied taxa, limiting its applicability across diverse European fish communities. Here we quantitatively synthesized 112 studies comprising 685,333 individuals of 50 European freshwater fish species yielding 953 effect sizes to examine abiotic triggers of spawning migration. Using a large-scale meta-analytical approach, we analysed multiple environmental variables that have been proposed to influence migration timing, including water temperature, flow, radiation, turbidity, rainfall, cloud cover, and air pressure. By comparing responses across species and life-history strategies, we explored those abiotic cues that allow generalization beyond individual case studies. Water temperature emerged as primary trigger of spawning migration across European freshwater fishes, while other environmental cues play a secondary or inconsistent role. We show that migration timing aligns closely with species' thermal limits, allowing spawning migrations to be grouped into broad thermal groups. This temperature-based perspective enables prediction of migration windows beyond individual species and offers a practical framework for timing fish passage and connectivity measures in fragmented river systems.

Primary Author: Abe Schneider

Affiliation: Natel Energy

Title: Design of high-performance turbine replacements for safe downstream eel passage at the 900 MW NYPA FDR-St. Lawrence Power Project

Key Words: Fish passage hydropower turbine

Abstract:

The presentation describes a work effort to design and computationally evaluate improved turbine runners to facilitate high rates of downstream passage survival for American eel at a large hydropower facility, the 900 MW FDR-St. Lawrence Power Project operated by the New York Power Authority.The St. Lawrence River is home to a very important population of American eel, a species which was once abundant in the region. The plant operator, New York Power Authority (NYPA), has proactively supported this population, notably with the installation of an award-winning upstream eel passage facility in 2007. Eels need to migrate downstream to the ocean as large adults, and testing at the project has shown turbine passage mortality to be around 26%.Natel Energy, an engineering consulting company with unique expertise on hydraulic design of high-performance turbines for safe downstream fish passage, was contracted by the Fisheries Enhancement and Mitigation Research Fund (FEMRF), administered by the US Fish and Wildlife Service, to assess the feasibility of replacing the existing hydroelectric turbines (16x 60-71 MW units, 5.8-6.1 m diameter) with new hydraulic designs. The objective of the study was to simultaneously enable high through-turbine passage survival rates of American eel (and other species), while maintaining current power production and operating with high efficiency and no cavitation. This study may inform future options and decisions on turbine rehabilitation or replacement, focusing on alternatives that can be carried out cost-effectively while achieving major improvements in fish passage on the St. Lawrence River.This presentation will share details on the design process, including insights into the computational fluid dynamic simulation effort and technical tradeoffs in the development of FishSafe runners at the FDR-St. Lawrence power project.

Primary Author: Shane Scott

Affiliation: SSA Environmental

Title: Restoring Habitat Connectivity: Retrofitting Culverts to Rapidly Improve Aquatic Organism Passage

Key Words: Culverts, AOP, Fish Passage

Abstract:

Culverts, bridges, and similar in-water structures rank second only to dams in obstructing fish and other aquatic organisms. These structures significantly impact habitat connectivity for numerous species by restricting access to crucial spawning and rearing habitats. While significant efforts are devoted to removing or replacing these barriers to enhance Aquatic Organism Passage (AOP), such projects are resource-intensive and often take years to complete. Consequently, given the vast number of barriers, many cannot be addressed through replacement in a timely manner, if at all.High water velocities and shallow water depths within these structures create hydraulic conditions that severely limit passage. This presentation provides an insightful exploration of low-cost, rapid solutions for retrofitting culverts to improve AOP where removal or replacement is not feasible. We will detail a spectrum of corrective actions, specifically the installation of flexible weirs and floating ramps designed to enhance access and passage through existing infrastructure. Special attention will be given to recent advances in materials that allow for flexible, durable baffles; unlike traditional rigid structures which reduce hydraulic capacity and trap debris, these innovative solutions improve AOP while passing debris at high flows with minimal effect on culvert capacity.To validate these methods, we will demonstrate how Computational Fluid Dynamics modeling is used to properly size, configure, and quantitatively describe the AOP benefits of these modifications. Finally, real-world case studies will be presented to demonstrate how these innovations have successfully improved AOP for a variety of species, including projects where modifications effectively facilitated the reintroduction of extirpated fish populations to historic habitats.

Primary Author: Nick Scribner

Affiliation: Wyoming Game and Fish Department

Title: Rubber Baffles - A low cost passage solution

Key Words: culvert baffles, hydraulics

Abstract:

Road crossings of streams are ubiquitous across Wyoming and the entire U.S. and have substantial impacts on aquatic organism movement. Recent efforts to populate the US-Fish & Wildlife Service fish passage prioritization tool has identified 560 road crossings in Wyoming impacting aquatic passage with thousands more to still assess. Undersized and inadequately placed structures are common characteristics that also impacts sediment transport and debris passage at these crossings. Complete replacement with a properly sized structure is the ideal remedy to improve stream function, connectivity, and long-term resiliency, but there are financial and labor constraints. Identifying low-cost solutions can increase our ability to enhance many more crossings for fish passage thereby reducing habitat fragmentation. Over the past five years, Wyoming Game and Fish personnel have installed rubber baffles to improve hydraulic conditions for fish passage across the state in 13 different culverts. They have included small crossings on US Forest Service gravel roads and larger crossings on state highways and interstate 80. Culvert diameters ranged from 3–12 ft (1-3.6 m), 40-360 ft (12.1-109 m) in length, and consisted of both concrete and metal material. Velocity and water depths were recorded in a subset (n = 5) of the structures before and after baffle installation. Velocities decreased an average of 69.8% from 2.9 ft/s to 0.9 ft/s (0.9 m/s to 0.3 m/s) and depths increased 2 to 3-fold at low base flows. Furthermore, culvert bottom velocities were dramatically reduced at higher flows, as much as 32-39% compared to mid-water column velocities. Evidence of improved passage and sediment retention were documented at several sites because of the improvement in hydraulic conditions. Rubber baffles are useful to improve passability of problem culverts while funding priorities slowly address crossings more appropriately.

Primary Author: Kirsten Sellheim

Affiliation: Cramer Fish Sciences

Title: Designing Floodplain Access for Salmon Under Highly Modified Flow Regimes: Balancing Benefits and Risks of Improving Lateral Passage

Key Words: stranding, floodplain, connectivity

Abstract:

Floodplain restoration and reconnection in California's Central Valley offers tremendous potential to boost juvenile salmonid growth and survival by providing access to food-rich, low-velocity habitats with lower predation pressure from non-native fishes. Yet, under highly regulated flow regimes, these benefits can be offset by stranding risks as restored floodplains evolve and floodwaters recede. This talk explores how modeling tools can be used to predict when floodplain inundation enhances migration success—and when it creates potential mortality traps by explicitly connecting the physical processes and landscape features that govern inundation, drainage, and connectivity to habitat restoration outcomes. We developed a juvenile salmonid trapping simulation model and used it to explore the benefits and risks of off-channel rearing under a range of hydrologic scenarios and trapping conditions. The model incorporates empirical estimates of growth, survival, and site-specific juvenile habitat capacity to explore population level responses under different hydrological conditions. Attendees will gain insight into risk-benefit tradeoffs across different passage configurations, trapping risk scenarios, and seasonal hydrologic regimes, and learn how these models inform decisions about where and when supporting lateral passage onto floodplains truly benefits salmon growth and emigration and how strength and direction of these effects are modulated by flow management.

Primary Author: Erin Settevendemio

Affiliation: HDR Engineering, Inc.

Title: Evaluating fish entrainment and turbine passage risk

Key Words: entrainment, turbine survival

Abstract:

In lieu of costly, difficult, and sometimes dangerous empirical entrainment studies, the EPRI databases were created to facilitate desktop evaluations of fish entrainment and survival. The U.S. Fish and Wildlife Service also developed a Turbine Blade Strike Assessment tool for estimating turbine passage survival, an alternative to the EPRI survival database. All desktop methods have limitations, and minimizing those limitations is imperative in estimating fish entrainment, mortality, and resultant potential effects to the fish community. This talk will review the available desktop entrainment and turbine mortality estimating tools and discuss simple ways to improve analyses with site-specific considerations when applying this current industry-standard approach.

Primary Author: Gabrielle Shay

Affiliation: University of North Carolina - Wilmington

Title: A multipronged approach to restoring migratory pathways and improving anadromous fish passage in a North Carolina coastal river

Key Words: Fish passage, bypass channel, anadromous, e-flows

Abstract:

During the early 20th century, three lock & dam structures (LDs) were built in the Cape Fear River, NC by the U.S. Army Corps of Engineers (USACE), creating barriers to anadromous fish migration. In 2012, the USACE created a nature-like fishway at the lowermost structure; however, subsequent studies found passage rates of striped bass (Morone saxatilis) were lower than those achieved through previous locking procedures. In response, modification of the fishway was completed in 2021 to improve passage. As an additional tactic, resource managers implemented elevated environmental flows (E-flow events) by timing water releases from an upstream reservoir with precipitation events to fully submerge the dams and facilitate upstream passage. Most recently, a network of natural bypass channels circumventing the fishway were also identified as a potential alternative pathway. Beginning in spring 2023, we quantified upstream passage of striped bass using both the modified fishway and the natural bypass channels during a range of flow conditions. Fish movements were informed by a large array (n > 60) of fixed acoustic receivers, including acoustic gates above and below each LD. The average raw upstream passage success (22%) of striped bass at the fishway from 2023-2025 was similar to passage success estimated for the original structure (2013-2015: 20-25%). E-flow events facilitated the vast majority (77.3%) of all passage events at all LDs during 2023-2025, with high flow events that included elongated periods of gradual declines in discharge being particularly influential. Expanded acoustic receiver coverage in 2024 and 2025 confirmed 18 upstream passages through the natural bypass channels and around the fishway. Despite limited improvements in fish passage success following fishway modifications, the combination of E-flow events and accessible natural bypass channels provides a promising alternative to facilitate fish passage past historic barriers.

Primary Author: Alice Shelly

Affiliation: Kleinschmidt Associates

Title: A Stochastic Simulation Framework for Early-Stage Evaluation of Downstream Fish Passage Effectiveness

Key Words: downstream fish passage, uncertainty analysis, aquatic species reintroduction

Abstract:

Planning downstream fish passage for aquatic species reintroductions often begins under substantial uncertainty, including limited biological information and incomplete designs for passage technologies that must ultimately function under site-specific hydrologic conditions. Despite these uncertainties, early decisions are required to focus engineering and biological efforts on the most promising passage alternatives. Decision matrices typically consider feasibility, cost, and effectiveness, where effectiveness is often represented by best professional judgment informed by performance observed at other sites. While uncertainty in effectiveness cannot be eliminated, an adaptive engineering process can progressively reduce uncertainty and improve performance through successive design stages.We present a stochastic simulation approach designed to support early-stage evaluation and comparison of downstream passage effectiveness under realistic hydrologic and biological conditions. The model simulates daily fish movements using stochastic migration timing, modified by flow cues derived from historical records or simulated future flow regimes. Daily pathway selection—including trap entry and dam pathways—and pathway-specific mortalities are included as flow-dependent processes allowed to vary within bounds informed by prior studies and professional judgment. By simulating distributions of flows, migration timing, and fish movement through alternative passage configurations, the framework produces probabilistic comparisons of relative passage success across a range of conditions.These outcome distributions provide a practical basis for screening passage concepts, narrowing the set of viable technologies, and refining performance targets and design priorities prior to detailed engineering analyses or biological studies. We demonstrate the approach in a case study using a Biological Performance Tool (BPT) for a reintroduction study in the North Yuba River, California. The tool helped stakeholders select two out of six alternatives for further development. The framework is transparent, computationally efficient, and well suited for iterative early-planning discussions, where explicitly accounting for uncertainty helps interdisciplinary communication and reduces downstream design risk.

Primary Author: Zachary Sherker

Affiliation: Oregon State University, The University of British Columbia

Title: Effectiveness monitoring of self-regulating tide gates to improve juvenile salmon access to critical floodplain habitat during overwinter rearing

Key Words: Salmon, Telemetry, Floodplain, Habitat restoration

Abstract:

Floodplains provide critical overwinter habitat for juvenile coho salmon; however, a large proportion of the historical floodplain habitat is blocked by tide gates. Tide gates are one-way doors integrated into dike systems to prevent inundation of the floodplain and allow freshwater drainage during low tides. One option for improving juvenile salmon access to floodplain habitats while mitigating upstream flooding is to replace tide gates with self-regulating gates, which are designed to remain open and allow for bi-directional flow until a set upstream water level is reached. We report the results from two studies investigating the effectiveness of self-regulating tide gates in improving juvenile salmon passage: one conducted in Coos Bay, Oregon (2009-10) and one conducted on the Fraser River, British Columbia (2022-24). We used stationary passive integrated transponder (PIT) telemetry antennas situated on either end of tide gates to document juvenile coho salmon passage through a top-mounted gate (control), a self-regulating gate (treatment), and an ungated off-channel site (reference). Tagged juvenile coho salmon were released near treatment sites and tracked through overwinter until spring out-migration (Nov-June). We found that self-regulating gates significantly improved juvenile salmon access to floodplain habitats and that fish exhibited longer floodplain residencies and higher overwinter survival upstream of these sites compared to top-mounted gates. Juvenile salmon passage and overwinter survival were highest at the ungated site, suggesting that any gate likely affects juvenile salmon migration patterns. Our results indicate that fish passage through the self-regulating tide gate could be further improved through small operational tweaks to remain open for longer during incoming tides, when juvenile salmon most commonly attempt passage into floodplain channels. Rehabilitating floodplain connectivity can aid the recovery of threatened Pacific salmon populations, with self-regulating tide gates serving as a potentially important tool to balance ecological restoration and flood risk management for upstream lands.

Primary Author: Melissa Shinbein

Affiliation: U.S. Bureau of Reclamation

Title: Testing of Boulder Clusters for Fish Passage: from Model to Field

Key Words: Boulder Clusters, Physical Modeling, Fish Passage

Abstract:

This research aimed to answer the question: How can restoration practitioners apply design guidance from physical and numerical modeling studies to identify the most effective boulder cluster configurations to improve aquatic habitat and fish passage?Since 2019, the Bureau of Reclamation's Hydraulics Laboratory in Denver, Colorado has conducted two Froude-scale physical hydraulic model studies, numerical modeling, and multiple site visits to investigate the placement of boulders in urban channels to provide the best habitat suitability for steelhead salmonids in several different settings. The first phase of this work analyzed the effect of boulder clusters on depth, velocity, and fish habitat using a physical and numerical model. After modeling was complete the tested configurations were then generalized to apply to any river restoration project that seeks to add geomorphic and hydraulic complexity while improving fish passage or aquatic habitat. In September 2024, a field exploration of these boulder clusters was conducted at multiple sites to assess the efficacy of the clusters outside of the laboratory setting. The long term goal of this project is to create boulder cluster design guidance to assist river restoration practitioners in meeting fish habitat objectives.

Primary Author: Luiz Silva

Affiliation: ETH-Zurich, Institute of Environmental Engineering, Switzerland

Title: Assessing cumulative fish passage through a cascade of hydropower plants reveals thinning and bidirectional movements

Key Words: Fishways, hydropower dams, cyprinids, bidirectional movements

Abstract:

Fish passage technologies are widely used to facilitate upstream migration through instream barriers, particularly hydropower plants (HPPs). However, their performance is most often evaluated at individual sites, emphasising local and unidirectional movements while overlooking cumulative impacts across multiple barriers. In river systems fragmented by HPP cascades, variability in site-specific passage efficiency can lead to progressive movement thinning. When species exhibit bidirectional movements to complete their life cycles, downstream passage may further amplify cumulative loss. Understanding these dynamics is essential for designing effective environmental flows, monitoring strategies, and real-time risk management interventions.In this study, we analysed a comprehensive dataset from a long-term fish passage monitoring program on the Rhine River, Switzerland, to quantify cumulative and bidirectional passage through a cascade of four HPPs. The dataset includes movements of 12,773 PIT-tagged cyprinids monitored over three years (2017–2019). We assessed seasonal patterns and proportions of upstream passage for four target species—barbel (Barbus barbus), bleak (Alburnus alburnus), chub (Squalius cephalus), and roach (Rutilus rutilus)—and characterised downstream movements, including identification of potential passage pathways.Upstream movements showed substantial thinning along the cascade, with fewer than 20% of individuals across species passing all four dams. Passage activity peaked in spring for barbel, bleak, and chub, while roach movements were predominantly observed in autumn. Across species, 2,094 bidirectional passage events were recorded, with barbel (24.2%) and chub (15.5%) exhibiting the highest proportions of downstream movements. All four species used both fishways and alternative routes during downstream passage.These findings highlight the importance of evaluating cumulative and bidirectional passage when restoring connectivity in regulated rivers. The pronounced thinning in upstream movements, combined with the proportion of downstream events, indicates that individuals may experience passage related risks. These factors underscore the need for improved and continuous monitoring of fish passages in HPP cascades.

Primary Author: Luiz Silva

Affiliation: ETH-Zurich, Institute of Environmental Engineering, Switzerland

Title: Evidence of Gas Bubble Disease in an Amazonian migratory fish and potential implications for fish passage

Key Words: Total Dissolved Gas, Hydropower, Neotropical fish

Abstract:

Fish mortality near hydropower facilities is increasingly reported worldwide. Total dissolved gas (TDG) supersaturation is identified as a major contributor to gas bubble disease (GBD) in aquatic organisms. TDG supersaturation typically arises during dam spill events, and once fish tissues become supersaturated, emboli can form in gills, fins, skin, and internal organs, leading to haemorrhaging, infection, behavioural changes, and mortality. Beyond these direct injuries, GBD can impair swimming performance and reduce physiological capacity—factors that may lower passage efficiency and undermine the effectiveness of fish passage structures. Although TDG thresholds are relatively well established for temperate species, tolerance varies widely among taxa, and empirical data for Neotropical fishes remain scarce. This gap limits the development of region-appropriate mitigation strategies in tropical basins undergoing rapid hydropower expansion.To address this, we developed a custom-built mobile TDG laboratory capable of generating stable and controlled supersaturation conditions directly in the field. Acute exposure experiments were conducted on Prochilodus nigricans, a migratory characiform fish of ecological and socioeconomic importance in the Amazon Basin. Individuals were exposed to four TDG treatments—control, 115%, 125%, and 130%. Fish were continuously monitored for behavioural responses, buoyancy issues, equilibrium loss, and visible GBD symptoms; external and internal lesions were assessed upon mortality or at 24 hours.Fish exposed to supersaturated conditions exhibited rapid onset of GBD symptoms, with emboli forming across external and internal tissues. Mortality occurred within 2–4 hours at 125% and 130% TDG, while no mortality occurred at 115% despite the presence of chronic sublethal lesions. These results indicate that P. nigricans is highly sensitive to TDG, with thresholds lower than those reported for many temperate species. Our findings underscore the need for region-specific TDG criteria and for integrating TDG risk into hydropower operations, fish passage design, and habitat restoration strategies in tropical river systems.

Primary Author: Caleen Sisk

Affiliation: Winnemem Wintu Tribe

Title: Following the Stars: Restoring Nur to the Winnemem Waywaket

Key Words: volitional fish passage, traditional ecological knowledge, restoration

Abstract:

In our language, Winnemem Wintu means “middle water people.” Since time immemorial, we have served as the ecological and spiritual caretakers of our ancestral watershed and its bountiful salmon runs. The Winnemem Waywaket (McCloud River in Northern California) is the center of our universe. The construction of the Shasta Dam interrupted our people's way of life and the migratory return of our Nur (Chinook salmon.) For decades we have continued our ceremonies and prayers that the salmon will return. We now know that salmon from our home river were offered safe haven in New Zealand a century ago. They deserve the opportunity to return to the place of their ancestral origin. When Shasta Dam was constructed in the 1940s and blocked the Nur from coming home, invaluable genetic diversity and adaptation gained over thousands of years were lost. Our intent is to return our wild Nur from New Zealand to the McCloud River to bring back genetic diversity and special survival traits retained in New Zealand. In 2023, the Winnemem Wintu Tribe signed historic agreements as equal partners with CDFW and NOAA to restore Nur to the Winnemem Waywaket. The Tribe prioritizes rematriating wild Nur from New Zealand, and has also partnered with agencies to provide more nature-like rearing and trapping strategies for reintroducing Winter Run salmon eggs above Shasta Dam. We are also working with partners to advance a volitional, “hands off”, fish passage route around Shasta and Keswick Dams so the Nur can swim freely from the mountains to the oceans and back and maintain their wild traits. As the salmon face extinction, our survival as a people is in peril - if the salmon do not exist, neither will we. Wild salmon are needed for healthy rivers, ecosystems, and people.

Primary Author: David Smith

Affiliation: Engineer Research and Deelopment Center

Title: Do fish make movement decisions based on total dissolved gas? A numerical case study from the Orta River, Norway

Key Words: TDG, Norway, fish, models

Abstract:

Total dissolved gas (TDG) is a common water quality impact from hydropower that can negatively effects fish. Management of TDG is an important consideration for effective hydropower production. While management actions are developed around TDG monitoring at a fixed point, TDG models suggest that its occurrence in rivers is spatially complex reflecting many interacting physical processes. In addition, fish may be able to react to TDG and choose to mitigate their exposure by moving to areas with less TDG. There is, however, some uncertainty about whether fish can spatially track TDG and make movement decisions to reduce TDG exposure. We present results from simulations that represent a 3D flow and TDG environment in the Orta River, Norway and we explore how individual fish exposure varies as a TDG based behavior is added. The results suggest a new method of assessing TDG exposure downstream of hydropower plants that is applicable for juvenile and adult fish migrating upstream, downstream or occurring as resident fishes. The method adds information and allows for a detailed exposure assessment that has potential to improve TDG management from a regulatory and operational perspective.

Primary Author: David Smith

Affiliation: Engineer Research and Development Center

Title: Assessing Zebra Mussels Impact on Fishway Efficiency: McNary Lock and Dam Case Study

Key Words: salmon, mussles, fish ladders

Abstract:

The Columbia River Basin faces a threat from the potential invasion of zebra mussels(Dreissena polymorpha), notorious for their ability to attach to various substrates, including concrete, which is common in fishway construction. Extensive mussel colonization within fishways may affect fish passage by altering flow patterns or creating physical barriers, leading to increased travel times, or potentially preventing passage altogether. Many factors affect mussel habitat suitability including vectors of dispersal, water parameters, and various hydrodynamic quantities, such as water depth, velocity, and turbulence. The objective of this study is to assess the potential for zebra mussels to attach to fishway surfaces and form colonies in the McNary Lock and Dam Oregon-shore fishway and evaluate the potential impact of this infestation on the fishway's efficiency. A computational fluid dynamics (CFD) model of the McNary Oregon-shore fishway was developed using the open-source code OpenFOAM, with the two-phase solver interFoam. Mesh quality is critical to obtain a reliable solution, so the numerical mesh was refined near the free surface and all solid surfaces to properly capture the complex flow patterns and free surface location. The simulation results for the 6-year average flow rate showed good agreement with the measured water column depth over each weir.Regions susceptible to mussel infestation were identified, and an analysis was performed to determine the mussel's preference to colonize as a function of the depth-averaged velocity, water depth, and wall shear stress. Habitat suitability criteria were applied to the output of the hydraulic variables from the CFD solution and provided insight into the potential impact on the fishway efficiency.

Primary Author: Kurt Smithgall

Affiliation: U.S. Bureau of Reclamation

Title: Hydraulic design challenges for downstream fish passage modification at Howard A. Hanson Dam

Key Words: Hydraulic modeling, High head fish passage

Abstract:

Federally owned high-head dams are increasingly being modified to incorporate fish passage facilities, presenting unique hydraulic design challenges. At Howard A. Hanson Dam, a downstream juvenile fish passage system was developed and evaluated using a 1:10 scale physical model at the Bureau of Reclamation's Hydraulics Laboratory. The model replicated key design components, including a multiport collector, steep-slope transition, 1,000-ft deceleration tunnel, and stilling basin. Testing revealed two significant hydraulic issues requiring design refinements: (1) jet detachment from an ogee spillway under gated flow conditions, resolved by integrating trajectory curves into the spillway profile; and (2) reattachment of a free jet following an air gap, addressed through deflector and insert configurations to optimize impact angle and flow stability. Iterative design improvements were supported by complementary numerical modeling. This presentation highlights the modeling approach, observed hydraulic phenomena, and solutions implemented to converge on a final design.

Primary Author: David Snyder

Affiliation: Washington State Department of Transportation

Title: A Watershed Approach to Fish Barrier Removal Along Chico Creek, Kitsap County, Washington

Key Words: Collaboration, Barriers, Restoration, Watershed

Abstract:

Beginning in 2014, the Washington State Department of Transportation (WSDOT), in partnership with Kitsap County, the Suquamish Tribe, and the Washington Department of Fish and Wildlife (WDFW) have worked collaboratively to identify barriers and restore access for salmon and trout throughout the Chico Creek watershed, located in Kitsap County, Washington. Between 2021 and 2024, WSDOT removed four barriers in lower Chico Creek with a price tag of nearly $58 million. This included three WSDOT owned barriers along a productive unnamed tributary and one WSDOT barrier on mainstem Chico Creek located under State Route (SR) 3, that connected to Puget Sound. With the culmination of this project, salmon and trout species once again have access to nearly 22 miles (35 km) of upstream habitat, including nearly 38 mi2 (60 km2) of spawning habitat and 165 mi2 (266 km2) of rearing habitat. To date, a total of 12 barrier removal projects has occurred throughout the watershed. However, before any construction could begin, teams from WDFW, under the direction of WSDOT, surveyed and assessed all the available habitat and inventoried any potential fish passage barriers located upstream of the SR 3 crossing. Thanks to the completion of this critical work, partners could prioritize their efforts to maximize the benefits for fish species potentially utilizing the Chico Creek watershed including chum, Chinook, coho, steelhead, coastal cutthroat and residential fish, as well as lamprey species. In the fall of 2024, following the completion of this massive restoration effort, Chico Creek saw one of the largest adult chum salmon runs in more than a decade, welcoming back tens of thousands of fish to this culturally significant system.

Primary Author: Shara Sparks

Affiliation: Resources Legacy Fund

Title: Models for funding dam removal projects, lessons learned from the Open Rivers Fund

Key Words: Funding, multi-benefit outcomes, community-driven

Abstract:

Since 2016, Resources Legacy Fund's Open Rivers Fund (ORF) program has helped dozens of communities across the American West restore rivers by removing obsolete dams and modernizing water infrastructure. With more than 130 ORF-supported projects now complete, ORF staff will share the specific and catalytic role philanthropic funding can have on dam removal when supporting a locally driven project model. A series of case studies will showcase how early philanthropic investments can support project development by funding the inclusion of a wide range of local stakeholders. These more diverse partnerships help ensure multi-benefit outcomes that include restoring fish passage and improving stream health, improving irrigation efficiency, eliminating safety hazards and liability, restoring Tribal rights and traditions, saving money, enhancing recreation, and more. Supporting this collaborative approach to dam removal offers a model for catalyzing community-supported projects and improving restoration outcomes while also positioning the projects to complete effectively for public funding. These types of inclusive projects, with uncommon partnerships, can also provide templates for crossing the political divide often visible in rural communities.

Primary Author: Maribelle (Mimi) Stanley

Affiliation: Pacific Northwest National Laboratory

Title: Making Surfaces SLIC: a New Nontoxic Antifouling Coating

Key Words: Biofouling, antifouling coating

Abstract:

Biofouling, particularly from algae and invasive mussels, restricts water flow through hydro facilities, which forces expensive, manual cleaning shutdowns and reduces overall energy production. Pacific Northwest National Laboratory (PNNL), with support from the Department of Energy's Water Power Technologies Office and a group of industry partners, has developed a cheap, environmentally friendly antifouling coating that is designed to prevent settling and attachment of native and non-native fouling organisms such as mussels. Inspired by nature, the Superhydrophobic Lubricant-Infused Composite (SLIC™) coating has a carefully controlled texture and chemistry that mimics what is found on the leaves of the lotus flower, which also must stay clean in aquatic environments. Moreover, the coating contains a lubricant on the surface that behaves like the slime that forms over fish scales. Together, these mechanisms inhibit the attachment of organic and biological matter and make it easier to clean off when it does attach. PNNL is partnering with federal hydropower stakeholders and a commercial shellfish operator to demonstrate and deploy SLIC™ on both hard surfaces like concrete and steel, and flexible surfaces like netting and mooring lines, which can be used for fish diversion or aquaculture. This presentation will detail the cooperative research and development partnerships that have been formed around SLIC™ and explore the challenges of bringing a new technology borne from basic research to commercial maturity.

Primary Author: Sydney Stark

Affiliation: University of California, Davis

Title: Improving Juvenile Chinook Passage through Sutter National Wildlife Refuge: Development of a Decision Tree to aid Managers and Salmon

Key Words: Salmon, Floodplain, Management, Sutter Bypass

Abstract:

Chinook Salmon (Oncorhynchus tshawytscha) were historically abundant in northern California with millions of fish migrating through the Central Valley. Today, population abundance is sustained primarily by hatchery production, while wild populations remain at low levels. Historically, extensive floodplain habitats along the Sacramento River provided juvenile Chinook Salmon access to abundant food resources. Now, the Sacramento River is lined with levees and the few remaining floodplains are found in the form of flood bypasses (e.g., Sutter Bypass and Yolo Bypass). Within these bypasses, a mosaic of agricultural fields and managed wetlands continue to provide important floodplain rearing habitat for juvenile salmon during flood events as they migrate to the Pacific Ocean. The Sutter National Wildlife Refuge (SNWR), at the bottom of the Sutter Bypass, originally managed for waterfowl has been increasingly recognized as important fish habitat as well. Over the past three years, we partnered with SNWR to study juvenile Chinook Salmon movement through their managed wetlands and developed a decision framework to help inform fish passage needs before spring conditions become unsuitable. Research evaluated simple infrastructure modifications, including irrigation boards with fish passage openings and pulse flows to encourage outmigration. These efforts resulted in a management decision tree that guides the SNWR staff in balancing waterfowl management with seasonal salmon habitat needs.

Primary Author: Anna Steel

Affiliation: Department of Wildlife, Fish, and Conservation Biology, University of California, Davis

Title: Assessing mortality rates of young green sturgeon during passage at a protective fish screen

Key Words: Screen Criteria, Water Diversion, Sturgeon, Downstream Passage

Abstract:

Fish screens are commonly installed at water diversions to prevent direct entrainment of fishes and facilitate safe and effective downstream passage. Current screen criteria were developed from information about salmonid swimming performance, and may inadequately protect fish with weaker swimming capacities, such as sturgeon. Green Sturgeon rear in the Sacramento and San Joaquin watersheds where they are exposed to multiple water diversions at different ontogenetic stages. Here we evaluated the interactions of young green sturgeon (Acipenser medirostris) with a vertical-slot flat-plate fish screen (50% open area, 1.75mm bar spacing) at varying operational flow velocities. We conducted the study within a large annular flume equipped with a model fish screen designed to create continuous screen exposure conditions, and measured lethal consequences of exposure across larval sizes and under varying flow conditions. Results indicate a period of high vulnerability for larvae (25 – 45mm FL), when faster velocities result in increased mortality. Behavioral responses, such as distance from screen, transit speeds, and orientation, provide additional context for the mortality observed. This study demonstrates that current salmonid-based screening criteria may be supportive of safe passage for juvenile sturgeon greater than 60mm FL, but appear insufficient for protecting larval green sturgeon under 50mm FL, underscoring the need for development of species- and stage-specific screen criteria tailored to fish with weaker swimming capacity. By incorporating these findings into existing models of early life stage survival of sturgeon, we may be able to identify new and effective opportunities for reducing mortality and supporting the declining populations of California Sturgeon.

Primary Author: Kai Steimle

Affiliation: Kleinschmidt Associates

Title: Biological Considerations in Fish Passage Design

Key Words: Design Biological

Abstract:

Tailoring fish passage designs to site conditions requires consideration of a wide range of biological information during early planning stages. Key biological considerations are multiscale; ecological context including the fish assemblage, life-history, population status, and restoration goals inform passage targets, timing, and capacity. Aquatic habitat conditions, fish behavior, disease, and predation can inform site design goals and constraints. Regulatory requirements further influence design and implementation strategies. This presentation shares project experience to illustrate how biological data collection can improve and expand viable design alternatives for effective fish passage solutions.

Primary Author: Holly Steindorf

Affiliation: California Fish Passage Forum

Title: About the California Fish Passage Forum: Partnership for the Collaboration and Funding of Fish Passage Improvement

Key Words: National Fish Habitat Partnership, Partnership, Fish Passage Funding, Collaboration

Abstract:

The California Fish Passage Forum is a Fish Habitat Partnership supported by the National Fish Habitat Partnership (NFHP). The Forum is a collaborative entity formed among state, local, and federal agencies, fisheries conservation groups, researchers, restoration contractors, and other interested parties dedicated to restoring connectivity of freshwater and estuarine habitats throughout the historic range of anadromous fish in California by promoting collaboration among public and private sectors for fish passage improvement projects and programs.The Forum leverages partnerships to expedite conservation of California's anadromous fish by working cooperatively to provide fish passage funding, increase information sharing, develop resources for practitioners, advocate for simplified permitting pathways, and outreach the benefits of investments to aquatic connectivity. Each year the Forum provides funding towards research, monitoring, assessment, and barrier removal projects that help restore connectivity of freshwater habitats in the current and historical range of anadromous fish. This funding can be used to cover hard-to-fund project expenses and leverage additional funding sources.The Forum invites conference attendees to consider how the California Fish Passage Forum can help advance their restoration work. Options include applying to the Forums restoration funding opportunity, utilizing the Forums rapid assessment protocol and California Passage Assessment Database in their work, or their agency, nonprofit, restoration group or tribal partner joining the Forum as a signatory.

Primary Author: Michael Stephenson

Affiliation: Idaho Power Company

Title: Quagga mussels in the Snake River, Idaho

Key Words: Invasive Mussels

Abstract:

In 2023, live quagga mussels were discovered in the Snake River near Twin Falls, Idaho. Idaho State Department of Agriculture implemented chemical treatments of the river in three consecutive years to eradicate this invasive species. Idaho Power operates two hydroelectric facilities in this area and was directly involved in the treatments. This presentation will discuss Idaho Power's preparations for an infestation; our role in the treatments and the lessons learned; and what we are doing moving forward.

Primary Author: Lucas Stiles

Affiliation: Kleinschmidt Associates

Title: A Collaborative Approach to Assessing Downstream Fish Passage Alternatives

Key Words: Downstream Fish Passage

Abstract:

Improving downstream fish passage at hydropower facilities is a challenge many dam owners face. This presentation will focus on a recent collaborative feasibility study conducted by Kleinschmidt Associates and Natel Energy to look at potential alternatives for downstream passage at a hydropower facility in New England. The study included a comprehensive evaluation of alternatives to improve the effectiveness of the existing downstream fish passage system. Alternatives that were considered included a floating guidance boom and improved bypass structure, a new angled intake structure with close-spaced bar racks and an improved bypass structure, a new inclined intake rack with close spaced bars and an improved bypass structure, and replacement of the existing Kaplan turbine runners with Natel's FishSafe™ RHT runners to improve survival of fish that pass through the turbines. Both Kleinschmidt and Natel used computational fluid dynamics (CFD) modeling and other tools to assess the performance of each of the alternatives. Natel also completed CFD-based fish survival modeling for the various species and life stages that looked at both blade strike and barotrauma.

Primary Author: Jacob Stout

Affiliation: Stantec

Title: Quantifying Entrainment of Resident Fishes at Hydropower Facilities in the Middle Fork American River, California – Feasibility and Project Implementation

Key Words: Entrainment, Tagging, Monitoring

Abstract:

For Placer County Water Agency (PCWA), Stantec is implementing a Passive Integrated Transponder (PIT) tagging study to quantify potential fish entrainment at Ralston Powerhouse. Monitoring of potential fish entrainment at the powerhouse presents challenges associated with site access, powerhouse operations, high velocities, expensive antenna installation, and debris. After completion of a feasibility study, PCWA and resource agencies agreed to utilize PIT tags to study entrainment at the Ralston Powerhouse. The feasibility study evaluated the Middle Fork American River Project (MFP) infrastructure and hydrodynamics to determine whether a detection array could be installed at the powerhouse outflow. Considerations included tag detection efficiency and the logistics of installation (e.g., antenna array design, installation timing, power supply, and database setup). The large, low velocity intake to Ralston Powerhouse was not suitable for an antenna because of the presence of a large metal intake grate. Once it was determined to be theoretically feasible to utilize PIT tags at the Ralston Powerhouse outflow, Biomark custom-fabricated and installed two 12' x 12' detection antenna arrays with the assistance of divers. In November 2025, rainbow trout (Oncorhynchus mykiss) and brown trout (Salmo trutta) were captured in the Middle Fork Interbay and directly upstream in the Middle Fork American River via electrofishing. The river sampling required helicopter support to move people and electrofishing gear. A total of 779 fish were tagged. Efficiency testing and entrainment monitoring is ongoing at the powerhouse. Entrainment monitoring of tagged fish and efficiency testing will continue for one year. The PIT tag antennas will be removed during the fall maintenance outage October 2026. A report describing observed fish entrainment in relation to the location of the tagged fish and the standing crop of fish in the river and Middle Fork Interbay will be available in the first quarter of 2027.

Primary Author: Adrian Strain

Affiliation: HDR Engineering, Inc.

Title: Coupling Three-Dimensional Near Field Hydraulics and Fish Passage Design

Key Words: Computational Fluid Dynamics, CFD, Fish Passage, Screens

Abstract:

The application of computational fluid dynamics (CFD) has become more common as fish passage design and analysis seek better understanding of the hydrodynamic flow fields. A well-executed numerical model study can provide a wealth of data for designers and biologists to digest. The data can lead to more efficient use of flow, allowing operators to maximize the biological benefits while maintaining preferred discharge ratings. Conversely, the deep dive into the numerical data can raise questions that go against status quo and require designers to re-evaluate their typical approach. One project that highlights the benefits of CFD as a tool to help analyze the three-dimensional hydrodynamic flow field is the fish passage evaluation at Essex 19 Hydroelectric plant. The fish passage analysis focused on the attraction flow of the downstream passage facilities. The downstream migrants are collected at two slots in the trash rack. As downstream migrants pass through the system, they encounter a steep chute and plunge pool. The numerical model used field data to verify model parameters and simulate the hydraulics through the system. The model analysis focused on velocity magnitude, flow patterns, and plunging flows and was used to inform the re-licensing process. A second model study at a screening structure raised questions on how guidance may be applied. Sweeping velocity was identified as a design requirement and used to produce preliminary concepts. As a part of the project a CFD model study was used to simulate approach flows, flow separations, and hydrodynamic forces on the internal support structure. Numerical baffles were used to represent the screens and returned interesting results spurring conversations and discussion on the intent of the guidelines and how to practically apply it to the project. The result of the discussion lead to the use of a first principles approach to applying the guidelines.

Primary Author: Adrian Strain

Affiliation: HDR Engineering, Inc.

Title: Sacramento Weir Fish Passage System: Hydraulic Modeling and Design

Key Words: Computational Fluid Dynamics, CFD, Sacramento Weir, Slot-Orifice

Abstract:

The numerical modeling approach for the Sacramento Weir Fish Passage design followed a structured, multitiered progression—from one dimensional (1D) screening analyses to two dimensional (2D) hydraulic modeling and ultimately to three dimensional (3D) computational fluid dynamics (CFD). As the design progressively moved towards the final, each stage required increasing levels of hydraulic detail, computational resolution, and more specific levels of biologic information, and the tiered model methodology perfectly fit these requirements. Initial 1D hydraulic modeling served as a computationally efficient tool to evaluate numerous conceptual fish passage configurations. Using simplified representations of headwater–tailwater relationships, pool geometry, and energy dissipation, the 1D model provided insights into ladder length, number of pools, slot widths, and allowable head differentials. These results helped set the project footprint by narrowing the design space and identifying feasible alternatives.Building on the 1D outcomes, 2D hydrodynamic modeling (HECRAS 2D) was employed to capture spatial variability in depth and velocity fields, especially near transitions, turns, and channel expansions. The model results revealed flow concentration zones, recirculation patterns, and areas prone to excessive velocity or insufficient depth. The 2D model provided a nuanced understanding of fish passage hydraulics during varying headwater and tailwater conditions, leading to design refinement that included channel linings, baffle spacing, and energy dissipation features.Finally, 3D CFD modeling (FLOW3D) was used to simulate complex, three-dimensional flow structures within the fish ladder and passage channels. CFD captured vertical velocity gradients, turbulence, and localized flow structures such as jets, vortices, and shear layers that cannot be resolved in lower dimensional models. These insights were pivotal in the final refinements of baffle geometry, slot orientation, and flow control gate operation.Together, the 1D–2D–3D modeling framework provided a robust, iterative design process, enabling engineering optimization while considering hydraulic, ecological performance and regulatory compliance.

Primary Author: Jess Straub

Affiliation: River Focus, Inc.

Title: Agency Consultation and Stakeholder Considerations for Fish Passage Projects

Key Words: Fish passage, agency consultation, stakeholder considerations

Abstract:

Successful fish passage projects require a balance of engineering precision and policy consensus. The U.S. Fish and Wildlife Service (USFWS) Fish Passage Engineering team provides technical expertise to support FERC licensing and ESA consultations. This presentation examines how engineers align technical designs with regulatory mandates to ensure project viability.
We will outline strategies for coordination among federal agencies, state regulators, and tribal governments. Effective project management requires integrating tribal jurisdictional priorities and community interests from the initial planning stages.
By applying the USFWS Project Sequence framework, we demonstrate how early engagement mitigates regulatory risk and prevents costly construction delays. Attendees will gain a better understanding of the workflow between technical standards and regulatory compliance. We will also discuss how standardized design guidelines provide a transparent baseline for interagency consultation and long-term environmental stewardship.

Primary Author: Beth Styler Barry

Affiliation: The Nature Conservancy

Title: Evaluating Public Safety and Economic Factors in Dam Removal Decisions

Key Words: Economics, Flooding, Dam removal, Public Safety

Abstract:

Decisions around dam removal are complex and go well beyond ecological considerations. Economic impacts and flood risk reduction are often factors influencing whether dam owners, communities, and public agencies support removal. These projects involve many interested parties with a stake in either the status quo or in the restored river. The Nature Conservancy's Free River Accelerator is developing scalable decision-making tools to help interested parties better understand the economic and public safety benefits of dam removal. This presentation will discuss tools that help dam owners and communities analyze factors that may generate community benefits. To support decision-makers across all stakeholder groups involved in a dam removal process, we are developing a scalable, nested return-on-investment (ROI) framework. The framework begins with a systematic assessment of financial (market) impacts for all affected parties (e.g. dam owners, governments, lease holders) under the most likely scenarios. It then expands to incorporate non-market monetary values that are available and relevant to decision-makers. This nested approach makes monetary costs and benefits transparent and explicitly attributes them to specific stakeholders. Economic benefits and tradeoffs are subsequently layered in to provide a comprehensive and transparent full economic accounting of the dam removal decision. In addition to economic considerations, we increasingly see dam removals designed to include, or even center, community resilience considerations. Dams, and the mills they were built to power, often became town centers and a hub of residential and commercial building. Removal of obsolete dams can eliminate public safety hazards, and associated liabilities in these communities. We describe a standard decision-making process to determine if a particular dam removal will eliminate the flooding caused by the structure. This process includes a review of historical flooding, FEMA maps, review of the H&H modeling and other resources such as FEMA Flood Insurance Studies. These analyses help decision-makers assess public safety and risk-reduction alongside ecological and economic benefits.

Primary Author: Holly Swan

Affiliation: California Trout

Title: Iron Canyon Fish Passage Project: an ecosystem- and community-based approach to restoration

Key Words: stream simulation, community, reintroduction

Abstract:

Big Chico Creek (Ótakim Séwi in Maidu) is a free-flowing tributary to the Sacramento River that historically supported a diverse fish assemblage comprised of suckers, minnows, sculpin, lamprey, and threatened salmonids – spring-run Chinook salmon and steelhead. However, a barrier located in Iron Canyon in the form of a dilapidated fish ladder and a dense boulder complex currently blocks upstream migration of anadromous fishes and restricts movement of other native fishes.Big Chico Creek is the lifeblood of the Chico community – the creek runs through Chico State University, downtown Chico, a 3,760-acre public park (Bidwell Park), and the Big Chico Creek Ecological Reserve. The Iron Canyon Fish Passage Project lies in the heart of Upper Bidwell Park, the crown jewel of Chico, making the integration of the local community paramount to the success of the project. The Ótakim Séwi Fish Passage Collaborative – a joint effort by California Trout, the Mechoopda Indian Tribe, the City of Chico, and the Big Chico Creek Ecological Reserve – was formed to alleviate the barrier at Iron Canyon, reintroduce native fish species that were eradicated from the watershed following a piscicide treatment in the 1980s, and engage the local community in topics of cultural stewardship and watershed health.The fish passage component of the project has been designed following a stream simulation approach and will be constructed by removing the failing fish ladder and rearranging instream boulders to create a series of step-pools to overcome approximately 30 feet of elevation. This progressive approach has been successfully completed just one other time and can be looked to as a case study for future restoration efforts in the face of climate change.

Primary Author: Nick Szigeti

Affiliation: HDR Engineering, Inc.

Title: From Concept to Comeback: Lessons from 20 years of Fish Passage on Quiota Creek

Key Words: water crossings, SoCal, monitoring, steelhead

Abstract:

Since 2007, HDR has partnered with the Cachuma Operation and Maintenance Board (COMB) to plan, design, permit, construct, monitor, and repair, as necessary, ten water crossings on Quiota Creek in the Santa Ynez Valley. These projects were implemented between 2008 and 2020 as part of the Quiota Creek Fish Passage Enhancement Plan and Program to restore ecological connectivity to critical habitat for federally endangered Southern California Steelhead (O. mykiss), reestablish natural sediment and flow regimes, and greatly improve private and public access.These crossings are well into the monitoring phase, each having been implemented for 5+ years, which allows us to begin to understand how these projects have influenced the project reach. Annual monitoring and post-storm assessments, including after an extreme regional storm event in 2023, revealed unexpected strengths and vulnerabilities of the original designs under evolving hydrologic and sediment regimes. Observed vertical and horizontal channel adjustments, scour and displacement, and changes in habitat complexity prompted targeted remediation efforts and design refinements to sustain passage performance in the near-term.By reflecting on nearly two decades of implementation and stewardship, this case study demonstrates how fish passage projects function as dynamic systems rather than static installations. Adaptive management, resilient design, and sustained partnerships support long-established restoration and revitalization goals while maintaining long-term fish passage functionality in the face of unexpected change. This presentation details the successes, challenges, and recommended practices learned from the project.

Primary Author: Zachary Taylor

Affiliation: Kleinschmidt Associates

Title: 3D CFD modeling in the planning and design of fish passage facilities

Key Words: CFD, hydraulics, fish guidance

Abstract:

All over the world fish encounter man-made structures impeding their migratory pathways, impacting their life cycle, and ultimately challenging their survival. In many countries, the owners of hydroelectric dams are required to provide passage of migratory fish over, around, or through their hydroelectric stations. One of the technologies that has become a foundational tool in the fish passage design process is 3-Dimensional (3D) Computational Fluid Dynamic (CFD) modeling. CFD modeling can be instrumental in analyzing the flow field and hydraulic conditions in and around hydroelectric stations, assessing fish passage facilities built to mitigate their environmental impact, and determining passage facilities ability to meet standard engineering design criteria identified by regulatory agencies and other professional and academic experts. Providing attractive and effective hydraulic conditions at fish passage facilities is instrumental for achieving successful passage of migratory fish species. This presentation will provide a high-level overview of 3D CFD modeling technologies and focus on the benefits of using 3D CFD modeling in the fish passage design process. This presentation will identify some of the common questions and challenges that can be resolved through the use of 3D CFD modeling and will also provide a number of case studies highlighting some specific real-world applications of 3D CFD modeling in the planning and design of both upstream and downstream fish passage facilities. We will review how 3D CFD modeling can be used to analyze far-field attraction (ability of fish to sense the presence of a route of passage in the larger field of flow as they approach a dam), near-field attraction (ability of fish to successfully enter a fishway), and the internal hydraulics of a fishway (detailed analysis of the conveyance flow and attraction flow through the hydraulic pathways within fishway structures).

Primary Author: Mark Tompkins

Affiliation: FlowWest

Title: Restoring Floodplain Connectivity for Juvenile Salmonids in an Urban Reach of the Tuolumne River

Key Words: floodplains, salmon, passage, restoration

Abstract:

The lower Tuolumne River has been impacted by a legacy of urban and agricultural encroachment and the loss of native riparian vegetation, off-channel wetlands, and channel complexity. This has resulted in reduced rearing habitat for juvenile salmonids, fragmented riparian forest, and poor water quality. The Carpenter Road Restoration Project (hereafter "Project"), primarily funded by the California Department of Water Resources (DWR) and planned for construction in summer 2026, will add new rearing habitat and food resources for juvenile fall-run Chinook salmon (Oncorhynchus tshawytscha) and California Central Valley (CCV) Steelhead (Oncorhynchus mykiss) by creating 13 acres of floodplain habitat and planting native vegetation on the north bank of the Tuolumne River. The Project is located within the City of Modesto in Stanislaus County, California and bordered by the river, Carpenter Road, residential use, and a regional wastewater treatment plant. The Project will utilize and reshape an existing depression to create floodplain habitat, which is currently disconnected from the Tuolumne River by an earthen berm. To enable fish access and egress, a fish passage/drainage channel will be carved through the berm and into the floodplain. Dendritic channels will stem off this channel to enhance connectivity and drainage and a small delta will be shaped along the river to increase the opportunity for salmonids to find and enter the site. Given the Project's location within a highly urban environment, this Project seeks to balance restoration goals with the presence of access roads, recreational bike paths, residential neighborhoods, and a clean-closed landfill site. When implemented, the Project will create off-channel rearing habitat for salmonids while also providing opportunities for future public engagement and education when combined with the City's regional river parkway planning efforts.

Primary Author: Ben Vaage

Affiliation: Pacific Northwest National Laboratory

Title: Evaluating Juvenile Salmon Passage and Survival During a Deep Drawdown at a High-Head Dam in Oregon

Key Words: Fish Passage, Salmon, High-Head Dam, Survival

Abstract:

Green Peter Dam (Green Peter) is a high-head dam (91 meters tall) located in the Willamette River Basin on the Middle Santiam River near Sweet Home, Oregon, USA. Green Peter has three routes of passage for out-migrating salmonids: spillway, turbines, and regulating outlets (RO). The reservoir elevation at full pool (spring spillway operations) is 1,015 feet above mean sea level (fmsl), the turbine intakes are at 817 fmsl, and the RO intakes are at 745 fmsl. During the fall of 2023, 2024, and 2025, the reservoir was drawn down to a target elevation of 780 fsml to evaluate passage and survival of juvenile Chinook salmon (Oncorhynchus tshawytscha) through the two ROs. A total of 1,855 juvenile Chinook salmon were tagged and released upstream of the reservoir in each fall of 2023–2025. Radio telemetry (RT) arrays at the dam and downstream tracked fish as they moved through the system. During the fall of 2023 a total of 319 fish (of 738 released; mean length = 158 mm) passed through the ROs with an estimated survival rate of 72.7% (standard error [SE] = 2.8%). In the fall of 2024, 160 juvenile salmon (of 564 released; mean length = 160 mm) passed through the ROs with an estimated survival rate of 71.9% (SE = 3.9%). Finally, a total of 553 juvenile Chinook salmon (mean length = 133 mm) were released during a fall draw down in 2025. Analyses of survival and passage in 2025 are currently ongoing, and results will be presented at the conference. The results from this multi-year study will inform if the deep drawdown and RO operation in fall is a benefit for downstream migrating fish.

Primary Author: Liz Vasquez

Affiliation: California Department of Water Resources

Title: Decades in the Making: Improving Adult Fish Passage and Enhancing Salmonid Habitat in the Yolo Bypass with the Yolo Notch Project

Key Words: Big Notch, Yolo Bypass, Fremont Weir

Abstract:

In November 2025, Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project, more commonly referred to as Big Notch or Yolo Notch Project, the newest and largest Yolo Bypass Fish Facility, was operated for the first time by DWR. Operation of this facility improves fish habitat and passage for salmonids, sturgeons, and other native fishes in the Yolo Bypass. After more than 20 years in development, DWR intends to use Yolo Notch Project to improve fish passage of adult salmonids and sturgeons as well as increase the frequency, area, and duration of inundation of juvenile salmonid flood plain rearing habitat in the Yolo Bypass. Designed to maximize the duration of adult anadromous fish passage using a bottom hinged gating system, Yolo Notch Project also allows for water to enter the Yolo Bypass at much lower water surface elevations of the Sacramento River compared to pre-Project conditions. Beyond providing an improved fish migration pathway, Yolo Notch Project operations will inundate approximately 30,000 acres of Yolo Bypass habitat prior to typical Fremont Weir overtopping events. As we move into full operations, DWR is evaluating performance of Yolo Notch Project operations by implementing a multi-factor adaptive management plan. To do so, DWR will leverage existing studies in the bypass such as screw trap data and fyke trap monitoring, add new components to studies such as telemetry movement of adult salmonids and sturgeon, and initiate new studies such as juvenile salmonid entrainment evaluation and sonar camera analysis. This will allow us to monitor efficacy in meeting our performance objectives and optimize operation of Yolo Notch Project to allow for better integration of the Yolo Bypass Fish Facilities overall.

Primary Author: Andrew Veary

Affiliation: Cramer Fish Sciences

Title: From Hours to Seconds: High-Throughput AI for Fish Escapement Estimates

Key Words: automation salmon monitoring pipeline

Abstract:

Accurate escapement estimates for migratory species, including Pacific salmonids, are fundamental to stock assessment, regulatory decision-making, and evaluation of fish passage and restoration effectiveness. Video monitoring at passage facilities and monitoring sites provides a non-invasive means of collecting these data, but manual review of continuous video footage requires thousands of hours of expert labor, creating a major bottleneck for timely and scalable monitoring. We developed a high-throughput artificial intelligence (AI) pipeline that integrates object detection, instance segmentation, and multi-object tracking to automate fish passage video review and generate standardized abundance metrics. The system processes continuous underwater video from fixed cameras, combining object detection, segmentation, and keypoint detection models to identify species, delineate individual fish, and extract morphometric measurements from each observation. By linking detections across frames, the pipeline produces individual trajectories that enable automated estimation of passage counts, movement direction (immigration versus emigration), timing, and passage rates, while object detection outputs provide species and sex classifications—together mirroring the full suite of metrics generated through manual review. This pipeline processes footage faster than in real time. Automated outputs, evaluated against manually reviewed video for accuracy, bias, and efficiency, showed strong agreement with human observers on key passage metrics while reducing manual review effort by orders of magnitude. The transformation of labor-intensive video review into an automated, standardized, workflow improves the consistency and scalability of migratory fish monitoring programs. Integrating modern computer vision techniques into fish passage assessment supports more reliable abundance estimates and enables biologists and managers to focus on interpretation, adaptive management, and long-term restoration planning across the San Francisco Bay system.

Primary Author: David Vetsch

Affiliation: Laboratory of Hydraulics, Hydrology and Glaciology (VAW), ETH Zurich, Switzerland

Title: Innovative bypass system: effect of hydraulics on the movement of European eel (Anguilla anguilla)

Key Words: Downstream fish migration, bypass system, bypass, weir, fish behavior, European eel, CFD modelling, live-fish test

Abstract:

Downstream migration of eels is often blocked by hydropower plants, and passage through turbines, spillways or over weirs exposes them to high risk of injury and mortality. Fish guidance racks with an adjacent bypass system (BS) are promising technologies to facilitate safe downstream passage. However, successful downstream passage depends on the hydraulic performance of the BS, with a BS weir as its central component for flow control. Thus, we designed innovative BS weir shapes, assessed their hydraulic performance through CFD simulations, and selected design candidates for experimental quantification of the movement responses of European eel (Anguilla anguilla). Three bypass weir designs, namely, short-crested straight ramp, short-crested S-shape ramp and long-crested S-shape ramp, were developed and tested with eels in a prototype-scaled FGS-BS system under two discharge conditions. The CFD simulations were carried out to characterize the flow field with a focus on spatial velocity gradient (SVG) distribution in the entrance and further inside the BS. The CFD results revealed localized high SVG, likely to trigger avoidance reactions of eel. Then live-fish experiments were conducted with a minimum number of 27 individuals per weir type and eel movements were recorded using submerged cameras. In this contribution, we present an integrated analysis combining CFD-derived flow fields with fish tracks extracted from the video footage, attempting to link eel behavior and BS hydraulics. This combined approach proved to be valuable for the design of BS. Our design strategy focused on identifying SVG thresholds through CFD simulations to optimize BS weir geometry and narrow design options for experimentation. Subsequently, experiments using selected designs proved useful for testing specific hypotheses regarding hydraulic constraints that could affect eel movements. These findings shed light on strategies to improve BS design and support safe, efficient downstream fish passage at hydropower plants and water intakes.

Primary Author: Jason Wagner

Affiliation: U.S. Bureau of Reclamation

Title: Cle Elum Revolutionary Helix fish passage

Key Words: Salmon fish passage

Abstract:

The Cle Elum Fish Passage project has spanned over a decade in design and construction. Located in Washington State, this project will allow for upstream and downstream salmon passage facilities at the Cle Elum Reservoir. Join the primary facility designer for a presentation covering facility design, construction of the downstream helical fish passage system, and the ongoing construction of the adult collection facility.

Primary Author: Jon Walsh

Affiliation: Pacific Gas & Electric

Title: Fish Screen and Ladder Operation – Lessons Learned from the Battle Creek Restoration Project

Key Words: Operator perspective, case study

Abstract:

Fish ladders and fish screens are critical measures in restoration of anadromous fishes in proximity of hydroelectric projects. Technical challenges in designing these structures to support safe passage through facilities are well documented, the range of issues that can arise in operation of these facilities are frequently understated. From an operational perspective, these systems provide a range of challenges as facility requirements for fish passage must be balanced with seasonal flow fluctuations, variability, debris loading, sediment transport, and maintenance needs, and often need continuous monitoring to navigate successfully. Collectively, these factors can increase operational burden, maintenance costs, and regulatory risk for operators striving to ensure effective and compliant fish passage performance.We present our experience with operating the fish screens and ladders on two dams (Eagle Canyon and North Fork Feeder dams) in the North Fork of Battle Creek as a case study for navigating these challenges. Operators have had to work collectively to maintain license requirements and fish passage while working through complications of sediment buildup, automation, and difficulties in passage monitoring at these facilities. We hope that the lessons learned can help other fish passage projects and highlight some important issues for effective operations of fish passage facilities that should be considered in design, as they are often critical to its success.

Primary Author: Jon Walsh

Affiliation: Pacific Gas & Electric

Title: Summary of anadromous fish passage monitoring in the Battle Creek Restoration Project

Key Words: Reintroduction, restoration, monitoring

Abstract:

Battle Creek is a key tributary to the Sacramento River in Northern California, and the only one that has all four runs of Central Valley Chinook Salmon (Onchorhynchus tshawytscha, [Chinook]) as well as California Central Valley steelhead (Onchorynchus mykiss). The watershed serves as critical habitat for threatened spring-run Chinook and critically endangered winter-run Chinook, and threatened steelhead. Restoration actions on the part of U.S. Fish and Wildlife Service, National Marine Fisheries Service, Bureau of Reclamation, California Department of Fish and Wildlife, and Pacific Gas & Electric began in 2001, with the goal of restoring salmonid populations and their habitat in 42 miles within Battle Creek and its tributaries.Understanding adult salmon movement within the watershed is essential for effective restoration and adaptive management efforts. This presentation summarizes the current understanding of spatial and temporal movement patterns of returning adult salmonids into Battle Creek; including passage at known natural barriers and through hydro-facilities.Upon entering the creek, fish are collected at Coleman National Fish Hatchery and passed upstream by hand. Genetics and other biological data are collected along with the ability to implant radio/acoustic telemetry tags into selected fish. Video monitoring is also used to enumerate passage as fish enter the creek and as they pass the hydro-facilities. In addition, snorkeling and redds surveys are also conducted which can show success passing facilities and known barriers. Temperature in relation to increased minimum flows and winter-run Chinook reintroduction efforts all play a role into what can be understood about fish passage in Battle Creek. This effort has documented the first known volitional passage of adult spring- and winter-run Chinook above Eagle Canyon dam in over a century.

Primary Author: Brian Wardman

Affiliation: Northwest Hydraulic Consultants

Title: Nature-like fishway design, construction, and post high flow observations

Key Words: Nature-like Fishway, Lessons Learned

Abstract:

NHC led the final design and implementation of a roughened rock ramp on Deer Creek near Vina California. The rock ramp is designed to pass unit flows of up to 190 cfs/ft over the approximately 75-foot-wide structure. The ramp was constructed at a 2% grade over approximately 215 feet of channel. The roughened rock ramp was constructed downstream of an existing concrete diversion structure to backwater the structure and allow volitional passage past the diversion site. The diversion structure historically required seasonal installation of flashboards to divert water into the adjacent diversion, however additional project work also regraded the diversion to reduce the need for flashboard installation allowing for year-round fish passage. The project was constructed in the summer of 2019. Over the following seven winters, the project has experienced two events with approximate 5-year return periods and a single event with an approximate 20-year return period. The roughened rock ramp has remained stable under the high flow conditions and continues to provide adequate diversion head and fish passage, however erosion near other project features has required maintenance. This talk provides a brief summary of key design approaches, construction methods, and observations of post-project performance relative to design expectations.

Primary Author: Andrew Yoder

Affiliation: Kleinschmidt Associates, University of Connecticut

Title: Automated Fish Passage Monitoring Using Open-Source Computer Vision Models

Key Words: Passage Monitoring Machine Learning

Abstract:

Continuing advancements in the field of computer science are driving innovation across environmental sciences. Capable machine learning and computer vision models are more accessible than ever and provide a strong opportunity for monitoring fish passage, given the amount of passage data that has been collected, which can be used to train these models. We have developed powerful, open source, computer vision models that are trained on prior studies to count previously unseen passage videos without human observation. These algorithms use state-of-the-art open-source transformer models, and it is our intent for our derived products to also remain publicly available. Using examples from RGB and sonar video data from New England, we identify fish and enhance understanding of best practices for computer vision-based fish passage video monitoring.

Primary Author: Shiyue Zhao

Affiliation: University of California, Davis

Title: Exploring Juvenile Green Sturgeon Swimming Behavior in Turbulent Flows: Implications for Fishway Design

Key Words: Sturgeon, turbulence, fishway design, swimming behavior

Abstract:

Turbulence features are likely a key factor affecting fish passage success. Despite its importance in influencing swimming behavior, studies specifically addressing fish responses to turbulence are limited, especially for benthically oriented fish. The southern distinct population segment (sDPS) of Green Sturgeon (Acipenser medirostris), a threatened anadromous fish species, is challenged by artificial barriers, such as dams and water infrastructure, which restrict their natural migration in California's rivers. These obstacles disrupt essential movement patterns, hindering reproduction and survival. This study investigates how juvenile (11.3±0.6 cm) Green Sturgeon respond to turbulent flows generated by D-shaped cylinders. Experiments were conducted in a glass flume (40.5 cm width), where individual fish were exposed to turbulent flows created by vertically mounted half-cylinders of varying diameters (2, 4, and 6 cm). During testing, water velocity was increased incrementally until fish reached exhaustion. To capture swimming behaviors and spatial preferences, cameras were positioned below the test area. Flow characteristics were measured using an Acoustic Doppler Velocimeter. The experiments analyzed 44 juvenile Green Sturgeons distributed among four treatment conditions: free-stream flow and three cylinder diameters. Water temperatures were maintained at 17.5±1.0°C to ensure consistent environmental conditions. Key swimming gaits, such as Kármán gaiting (where fish exploit energy from vortices in the flow) and spill behaviors, were observed and quantified. Spatial occupancy patterns were also analyzed to assess how fish distributed themselves under varying turbulence conditions. The results demonstrated that the fish's spatial occupancy shifted with different flow velocities and that the likelihood of Kármán gaiting and spill behaviors was related to changes in turbulence.

Primary Author: Ken Zillig

Affiliation: Fish, Wildlife and Conservation Biology Department, University of Minnesota

Title: Comparison of juvenile white sturgeon survival through a conventional and a novel hydropower turbine

Key Words: Downstream passage, Runner design, Injury and Mortality

Abstract:

Hydropower is a globally important renewable energy source with profound impacts on aquatic organisms, including direct injury and mortality to fish that move through hydropower facilities. While it is expected that the characteristics of turbine design and operation influence the type, frequency, and magnitude of injuries suffered by entrained fish, few direct comparisons exist to illustrate differences in fish survival outcomes for different blade designs. This study evaluated injury and mortality rates for juvenile white sturgeon (Acipenser transmontanus) passed through a turbine equipped with a runner with conventional blade profiles (thin, straight leading edges) and the same turbine equipped with a runner designed for improved fish survival (thick, slanted leading edges). Hydraulic head and turbine runner rotational speeds were matched across both turbine treatments and control treatments at blade peripheral speeds (n = 5) between 15.0 and 27.6 m/s. Fish were assessed for injuries following passage, and mortalities were assessed immediately after passage and after 48 hours. Conventional runner passage resulted in 42% to 78% survival after 48 hours, with approximately one-third of all tested fish killed by severe laceration. Under the same test conditions, immediate and 48 hour survival rates through the novel runner were 100% except at the highest speed condition (95.6% survival at 48 hours, n = 1 mortality). These results clearly indicate that turbine design has a profound effect on fish survival outcomes, and suggest that fish-focused design of hydropower equipment could significantly improve fish survival rates.

Primary Author: Ken Zillig

Affiliation: Fish, Wildlife, and Conservation Biology, University of Minnesota

Title: Sublethal physiological effects of passage through a fish-safe hydropower turbine

Key Words: Sturgeon Physiology, Growth Rate, Behavior, Stress

Abstract:

Turbine passage is a known cause of injury and mortality for fish moving downstream. Standard approaches to quantify mortality rates through turbines consist of an assessment of direct injuries and monitoring survival. However, the sublethal and delayed effects of turbine passage on physiological parameters such as growth rate, behavior, and biochemical stress response have not been quantified. These considerations are particularly important in the field of turbine design when the objective is to allow fish to pass without impacting their life cycle. This study quantified growth rate, behavioral changes, and blood physiology parameters in juvenile white sturgeon (Ascipenser transmontanus) passed through a turbine designed for improved fish survival, a no-turbine passage control, and a no-passage control. To simulate the effect of migration through multiple dams, a subset of fish was exposed to an additional passage event. Passage events were conducted at a low speed and a high speed (15.0 and 27.6 m/s blade tip speed, respectively). All passage fish survived the five-week post-trial period, and growth rates were positive across all treatment groups, but those that passed the turbine blade had overall slower growth (0.67 g day-1 vs. 0.75 or 0.76 g day-1 for the passage and non-passage controls, respectively). Blood physiology parameters (glucose and lactate) were elevated following passage across all treatments, but the addition of the runner did not increase the magnitude or duration of the stress response. Overall activity after passage was reduced across all treatments, indicating a default recovery response from the handling and experimental stress, but turbine presence and turbine velocity were not found to impact the behavioral response. The novel turbine runner design has minimal and seemingly transient sub-lethal effects. Paired with improvements in acute safety, the novel runner design is a significant opportunity to improve fish passage.