Whooshh Studies by Topic Area

Topic Area	#	Study/Project	Species	Location	Outcome	Report	Video
Migration Speed, Energy Reserves	1	CRITFC PIT-tagged comparative migration study	Sockeye	Priest Rapids, OLAFT facility	Whooshh tube transport over dam vs 15.5 vertical ft of ladder swim resulted in further/faster upstream migration, and no negative impact attributed to tube transport	Fryer, JK. 2017. Results of a PIT tag study at Priest Rapids Dam to assess the impact of the Whooshh Fish Transport System on upstream migrating Sockeye Salmon. Conducted by CRITFC. Whooshh Study 2016.	https://www.youtube.com/watch?v=TonkUuBKfyg
Fish Health, Physiology, Biochemistry and Survial	1	PNNL 2 tube lengths comparison with trap and haul	Chinook	Priest Rapids Hatchery, WA	No transport associated injury, indication of little to no stress nor impact on survival	Geist, DR, Colotelo, AH, Linley, TJ, Wagner, KA, and Miracle, AL., 2016. Physical, physiological, and reproductive effects on adult fall Chinook Salmon due to passage through a novel fish transport system. Journal of Fish and Wildlife Management. 7(2) 1-12.	https://www.youtube.com/watch?v=LaU7pm4DdQ4
	2	HDR comparison study with fluorscein epithelial damage assessment	American shad	Cataract dam, Maine	Safe transport,no appreciable scale loss or epithelial damange	Sears, M. 2017. American Shad Transport Feasibility Study Report. Conducted by HDR. Whooshh Study 2017.	
	3	EPRI/Alden Sturgeon transport	Strugeon	Legend Lake, WI	Although entry modification were required, safe transport and survival demonstrated with no epithelial injury	Amaral, S, Grant, T, Dearden, S, Pyatskowit, J and Jacobson, P., 2016. Powerpoint Presentation: Evaluation of Lake Sturgeon Passed through the Whooshh Fish Transport System. Presented at Fish Passage 2016 International Conference on River Connectivity.	
	4	SINTEF/AquaGen Broodstock tote vs Salmon Cannon transport	Atlantic Salmon	Norway	Safe transport and survival, biochemical analysis indicated less stress via tube transport than common practices	Erikson, U. et al., 2016. Evaluation of the Whooshh Fish Transport System for Transfer of Atlantic Salmon Broodstock Between Two Tanks. Conducted by SINTEF. Whooshh Study 2016.	https://www.youtube.com/watch?v=C47YeCTrD90&feature=youtu.be
	5	PNNL Volitional entry scan, sort	Chinook Steelhead	Ringold Hatchery, WA	Safe transport and survival, effective sorting	Garavelli, L, Linley, TJ, Bellgraph, BJ, Rhode, BM, Janak, JM, Colotelo, AH. 2019. Evaluation of passage and sorting of adult Pacific salmonids through a novel fish passage technology. Fisheries Research, 212 p 40-47.	
	6	Constellation fish transport condition assessment	Gizzard shad American shad	Conowingo, MD	Horizonatal transport requires tight water management in the tube as the shad are fragile, however with that survival and ~1000ft transport effective	Internal report in progress	
	7	Comparison long transport vs trap and haul, prototype technology evaluations	Sockeye	Cle Elum, WA	Many prototype technologies demonstrated. No opportunity (no fish) for volitional entry from the river. Truck transport fish from Priest Rapids were small. Effective transport demonstrated on appropreiately sized fish for tube. USBR require all fish regardless of size to be transported which did impact survival of smaller fish. Water management issues and limited fish restricted planned study.	1. Kock, T. et al., 2017. Evaluation of Sockeye Salmon after Passage through an Innovative Fish Passage System at Cle Elum Dam, Washington 2017. Conducted by USGS, USBR, Yakima Nation, and WA State Department of Ecology. Whooshh Study 2017. 2. Whooshh Report 2017. Whooshh Fish Transport System: Innovated Upstream Adult Fish Passage Installation at Cle Elum dam, Washington	https://www.youtube.com/watch?v=uCxNC5cJuOo
	8	EPRI/Alden Whooshh Floating Passage Portal	American shad	Santee Spillway, SC	Safe passage and survival.	Capone, K, Smaral, S, Rackovan, J, LaFontaine, J, Bryan, J, Holbrook, C, Jacobson, P. 2022, Evaluation of the Whooshh Passage Portal for Upstream Passage of American shad. Presented 152nd American Fisheries Socieity National meeting, Spokane, WA Aug 21-25.	
	9	U of IL and IL DNR Illinois river species imaging	Blue gill, Bigmouth buffalo, Common carp, Freshwater drum, Grass carp, Gizzard shad, Warmouth, Channel catfish, Silver carp, Bowfin	Emiquon Nature Conservancy, Illinois River, IL	Safe volitional entry, steeppass swim through scanning demonstrated on many species, condition assessed post imaging.	Lamer, J, Irons, K, Maxson, K, Phelps, K, Bryan, V, Bryan, J, Hamm, N. 2022. To pass or not to pass, that is the question: Evaluation of a selective steeppass fishway. Presented 152nd American Fisheries Socieity National meeting, Spokane, WA Aug 21-25.	
	10	USGS, GLFC Safe transport of multiple species	Gizzard shad, Largemouth Bass, Northern Pike, Rainbow Trout, Common White Sucker, Longnose Sucker, Walleye, Sea Lamprey	Hammond Bay, MI	Safe transport and survival	Miehls, S, Zielinski, D, Hrodey, P, Dearden, S. and Johnson, N. 2017. Proof-of-concept test of a differential pressure system to transport Great Lakes fishes. Conducted by USGS. Whooshh Study 2017.	
	11	Physiological responses of Rainbow trout to fish transport	Rainbow Trout	Troutlodge, Sumner, WA	Safe transport and survival	Mesa, MG. et al., 2013. Physiological Responses of Adult Rainbow Trout Experimentally Released Through a Unique Fish Conveyance Device. North American Journal of Fisheries Management. 33(6) 1179-1183.	
Reproduction Fecundity	1	Yakama three year comparison fish transport vs hand transport	Chinook	Roza dam, WA	Hand transport vs short tube transport directly to transport truck for drive to hatchery and hold until spawning. All fish PIT-tagged and condition and reproductive outcomes tracked. Tube transported fish as good or better survival and reporoductive outcomes and hand carry.	Fast, D, Johnson, M, Bosch, B and Bryan J. 2016. Whooshh Transport Survival Efficacy is Reproducible Across a Three Year Viability Assessment Study. Whooshh Study 2014-2016.	https://www.youtube.com/watch?v=Cy083c2MA7A&%3Bt=3s https://www.youtube.com/watch?v=1AUjD37DLLc
	2	SINTEF/AquaGen Broodstock tote vs Salmon Cannon transport	Atlantic Salmon	Norway	High fecundity maintained on high value broodstock as well as survival. Stress levels reduced using tube transport verses standed tote transport	Erikson, U. et al., 2016. Evaluation of the Whooshh Fish Transport System for Transfer of Atlantic Salmon Broodstock Between Two Tanks. Conducted by SINTEF. Whooshh Study 2016.	https://www.youtube.com/watch?v=C47YeCTrD90&feature=youtu.be
	3	PNNL 2 tube lengths comparison with trap and haul	Chinook	Priest Rapids Hatchery, WA	Higher survival and fecundity of tube transported fish vs simulated truck transport and controld	Geist, DR, Colotelo, AH, Linley, TJ, Wagner, KA, and Miracle, AL., 2016. Physical, physiological, and reproductive effects on adult fall Chinook Salmon due to passage through a novel fish transport system. Journal of Fish and Wildlife Management. 7(2) 1-12.	https://www.youtube.com/watch?v=LaU7pm4DdQ4
Volitional Autonomous Fish Passage (Passage Portal)	1	PNNL Volitional entry scan, sort	Chinook Steehead	Ringold Hatchery	High success rates of volitional entry, steeppass climb, imaging and automated sorting followed by transport, safe passage and survival	Garavelli, L, Linley, TJ, Bellgraph, BJ, Rhode, BM, Janak, JM, Colotelo, AH. 2019. Evaluation of passage and sorting of adult Pacific salmonids through a novel fish passage technology. Fisheries Research, 212 p 40-47.	
	2	DFO emergency fish passage	Chinook Sockeye	BigBar Slide, BC, Canada	Regulations limited days and times of transport however >17000 fish imaged and sorted and over 8000 transported over the BigBar slide	Whooshh Internal Report: Whooshh Passage Portal at Big Bar 2020, Final Report Dec. 10, 2020.	
	3	High head dam passage	Chinook	Chief Joseph Dam, WA	Limited fish numbers however volitoinal entry from flowbox through the system and passge up to the top of the 72M dam and back down safely demonstrated	Whooshh Report: S.A.V.E. Fish Passage Innovation Demonstration, Chief Joseph Dam, Summer 2019, Project Report p1-7.	https://www.youtube.com/watch?v=17gyh611alA
	4	Pool and weir to volitional entry and transport	Pink	White River, Buckley Dam, Sumner, WA	Several hundred Pink salmon pre-selected via bar grate, swam upthe constructed pool and weir steps to the false weir and volitonally entered the system. Transported directly into a transport truck.	Whooshh Fish Transport System - 2015 Buckley Study Report. Whooshh Study 2015.	https://youtu.be/Rx7UOvSMu-w
FishL Recognition Imaging	1	CRITFC, Columbia river species image capture at Adult Fish Facility of the Washington fish ladder	Chinook Sockeye Coho Steelhead American shad Peamouth Chub Northern Pikeminnow Whitefish Pacific lamprey Small mouth bass Large Scale Sucker	Bonneville Dam, Lower Columbia River, WA	Installation in the Bonneville Adult fish facility at the return to river pipe such that all fish entering the righ false weir and chutes not sorted by CRITFC for evaluation slid through the Fishl Recognition system and images, and size computations logged. Over 15000 fish scanned and classified.	Reports: 1. In-season Report for the end of the Skamania Steelhead Management Period (Task 3 Update 1) 2. In-Season Steelhead Report Task 3 Report 2 3. In-Season Steelhead Report Task 3 Report 3 4. In-Season Steelhead Report Task 3 Report 4 5. In-Season Steelhead Final Report Task 3 Report 5 6. In-Season Sockeye Report 7. Powerpoint Presentation: FishL™ Recognition Highlights through Aug 1, 2019	
	2	GLFD USGS Hammond Bay, Midwest rivers (7) species image capture from 9 locations	Walleye, Steelhead, Grass Carp, Big Head Carp, Silver Carp, Common Carp, Common White Sucker, Longnose sucker, Northern Hogsucker, Quillback, Redhorse, Sea lamprey, Small mouth bass, Goldfish, Rainbow Trout, Northern Pike, White Perch, White Bass, Freshwater Drum, Channel Catfish, Longnose Gar	Tittabawassee, Muskegon, Little Manistee, Illinois, Sandusky, Black Mallard, and Menominee - Rivers in Northern Midwest States, US	Fishl Recognition system mounted on a trailer for hand entry of fish was driven to 7 Midwest rivers and 9 sites to image caught fish to create a library of Midwest fish images and sizes. Over 5000 fish scanned and classified	1. Eickholt, J, Kelly, D, Bryan, J, Miehls, S, Zielinski, D. 2020. (Manuscript in preparation) Towards selective barrier passage by automatic species identification: Applications of deep convolutional neural networks on images of dewatered fish. To be submitted ICES Journal of Marine Science. 2. Bravata, N, Kelly, D, Eickholt, J, Bryan, J, Miehls, S, Zielinski, D. 2020. Applications of Deep Convolutional Neural Networks to Predict Biometric Parameters from Dewatered Images of Fish. Ecology and Evolution. DOI 10.1002/ece36618.	
	3	DFO emergency fish passage	Chinook Sockeye	BigBar Slide, BC, Canada	Over 17000 fish scanned and classified	Whooshh Internal Report: Whooshh Passage Portal at Big Bar 2020, Final Report Dec. 10, 2020.	
	4	Spokane and Colville Tribes Upper Columbia River image capture	10+ species	Lake Roosevelt, WA	Several hundred fish scanned and classified	Several hundred images classified for developmental efforts- no report generated	
	5	Constellation fish transport condition assessment	Gizzard shad American shad Snakehead Flathead catfish channel catfish blue catfish white catfish	Conowingo, MD	Over 1000 fish scanned and classified	Fall and Summer study report in preparation	
	6	WDFW image capture	Pink Chinook	Hoodsport Hatchery, Puget Sound, WA	Over 1000 fish scanned and classified	>1000 Images classified for developmental efforts- no report generated	
	7	Bellingham Technical College and WDFW Chum images	Chum	BTC WDFW Hatchery, Bellingham, WA	Over 300 Chum scanned	Several hundred images classified for developmental efforts- no report generated	
	8	U of IL and IL DNR, Illinois river species imaging	Blue gill, Bigmouth buffalo, Common capr, Freshwater drum, Grass carp, Gizzard shad, Warmouth, Channel catfish, Silver carp, Bowfin	Emiquon Nature Conservancy, Illinois River, IL	Over 1000 fish scanned and classified	Lamer, J, Irons, K, Maxson, K, Phelps, K, Bryan, V, Bryan, J, Hamm, N. 2022. To pass or not to pass, that is the question: Evaluation of a selective steeppass fishway. Presented 152nd American Fisheries Socieity National meeting, Spokane, WA Aug 21-25.	
	9	Downstream species imaging	Eel Atlantic slamon Sea Trout Roach	Herting, Falkenberg, Sweden	Downstream migration is less predictable than upstream. 94 fish scanned and classified during the fall and spring seasons.	Whooshh Report: Downstream Fish Passage Monitoring via the Whooshh Fishl™ Recognition System at Herting, Falkenberg, Sweden 2020-2021	
Transport Length and Height	1	Comparison Passage Portal long transport vs trap and haul	Sockeye	Cle Elum, WA	1700ft transport length with Booster at 1100 ft and 180 ft height	1. Kock, T. et al., 2017. Evaluation of Sockeye Salmon after Passage through an Innovative Fish Passage System at Cle Elum Dam, Washington 2017. Conducted by USGS, USBR, Yakima Nation, and WA State Department of Ecology. Whooshh Study 2017. 2. Whooshh Report 2017. Whooshh Fish Transport System: Innovated Upstream Adult Fish Passage Installation at Cle Elum dam, Washington	https://www.youtube.com/watch?v=uCxNC5cJuOo
	2	Yakama comparison fish transport	Chinook	Roza dam, WA	1100ft length and height over 100 ft transport	Fast, D, Johnson, M, Bosch, B and Bryan J. 2016. Whooshh Transport Survival Efficacy is Reproducible Across a Three Year Viability Assessment Study. Whooshh Study 2014-2016.	https://www.youtube.com/watch?v=Cy083c2MA7A&%3Bt=3s https://www.youtube.com/watch?v=1AUjD37DLLc
	3	Floating Passage Portal high head dam passage	Chinook	Chief Joseph Dam, WA	Vertical height passage up and down 72 meters from floating WPP to the top of the dam and back to the tailrace	Whooshh Report: S.A.V.E. Fish Passage Innovation Demonstration, Chief Joseph Dam, Summer 2019, Project Report p1-7.	https://www.youtube.com/watch?v=17gyh611alA
Traps	1	Land-based juvenile eel (elver) Switchback trap	Elver	Sweden	Customer evaluation of trap contents have demonstrated successful capture of healthy elver. Climbing substrate tested vs conventional substrates and EF-16 proven to be highly effective in faciliating safe and rapid elver climbs	Watz, J, Nilsson, PA, Degerman, E, Tamario, C, and Calles, O. 2019 Climbing the ladder: an evaluation of three different anguillid eel climbing substrata and placement of upstream passage solutions at migration barriers. Animal Conservation. doi:10.1111/acv.12485	
	2	Floating elver Elverator trap	Elver	Lilla Edet, Sweden	Elverator effectiveness comparisons vs pipe traps and ramp traps have proven it to be highly successful at capturing elver in greater number and lengths and acrss both day and night periods.	1. 2019 Whooshh Elverator, Extra Attraction for Guidance, and Elver Chamber Transport Study: Presentation and video 2. Sparrevik, E, and Elghagen, J. Test of a new elver collector at Lilla Edets powerstation. Preformed for Vattenfall. Whooshh Study 2018.	https://youtu.be/9SDo4ERXsrQ
	3	CRITFC Floating Pacific Lamprey collector	Pacific Lamprey	Columbia River, WA	In development, testing 2024		
	4	USGS Silvery Minnow trap	Silvery Minnow	Rio Grande, NM	Delivered during COVID, little feedback from USGS	Sale	
	5	China floating fish and egg custom traps		China	Delivered during COVID, little feedback from China client	Sale	
Hatchery hand load fish transport	1	Yakama comparison fish transport	Chinook	Roza dam, WA	Easy, safe hand load and transport. Better and safer for fish and fisheries personel	Fast, D, Johnson, M, Bosch, B and Bryan J. 2016. Whooshh Transport Survival Efficacy is Reproducible Across a Three Year Viability Assessment Study. Whooshh Study 2014-2016.	https://www.youtube.com/watch?v=Cy083c2MA7A&%3Bt=3s https://www.youtube.com/watch?v=1AUjD37DLLc
	2	WDFW in-river weir to transport truck	Tule Chinoock	Washougal, WA	Routinely used to increase efficiency of hatchery fish collections and transport to hatchery via tube transport into the truck. ~10 years of operation with 10' of thousands of fish transported safely	Sale	
	3	Colville Tribe in-river weir to trasnport truck	Chinook	Upper Columbia River, WA	Routinely used to increase efficiency of hatchery fish collections and transport to the shore from the weir trap	Sale	
	4	Umatilla Tribe hatchery to transport truck	Chinook	Nursery Bridge, OR	Solving the problem of moving fish from the sorting vault, up stairs and into a transport truck. Safer for fish and fisheries personel	Sale	
	5	Hoopa Tribe inriver weir to harvest tote	Chinook	Trinity river, CA	First use will be fall 2023 from in river weir to totes on the shore for harvesting	Sale	
	6	AquaBounty aquaculture transport for harvest	Atlantic salmon	Albany, IN	Streamlining fish processing path from tank to fish processing room	Sale	