

Dams and Fish Barge Transportation

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1. Fish have been transported for years via horseback and air craft to high mountain lakes, trucks to lowland ponds and lakes including goldfish from a county fair in a plastic bag. It has been proven that fish can be moved safely and effectively. The four purposes of barging were to reduce migration delay, eliminate predation, eliminate mortality at subsequent dams, and avoid gas super saturation caused by spill down the river to a release site below Bonneville dam.
2. Barging of ocean-bound Salmon and Steelhead smolts from upriver collection facilities to safe release sites in the lower Columbia River is one of the major tools used by the U. S. Army Corps of Engineers to reduce fish mortalities caused directly or indirectly by dams. Barges also prevent predation by birds, other fish, and sea lions as well as avoid lethal gas supersaturation caused by increased spill on the Columbia and Snake Rivers. Releases are made randomly by night at different locations several miles downstream from Bonneville dam, eliminating exposure to them where they concentrate.
3. In 1968 a system of collecting and trucking juveniles around hydroelectric dams began. The adult returns from this program showed positive results, but this system was limited to the carrying capacity of the truck fleet. Each truck was limited to about 1750 pounds of fish or about 17,500 smolts, with aeration, refrigeration and oxygenation systems on board. The fish capacity was limited by fisheries agencies from 20 fish per pound in hatchery stocking trucks to half that, thus the 10 fish per pound. There are as many as 15 fish per pound depending on size.
4. In 1977 a low snow pack resulted in a very low water year that greatly delayed the juvenile out-migration through the reservoirs. If a large-scale transportation program (Barging), had not been implemented, the smolt mortality would have been catastrophic. The two barges used in 1977 were leased paper mill effluent barges

that were modified by the Corps for emergency fish transport. Two army surplus water barges were obtained that were converted into the 2000 series first used in 1978. More barges have been added over time, a total of eight are now in the fleet. There have been many improvements to enhance the safety and security of the fish. Again in 2001, extreme low water caused agency and tribal representatives to fear a massive loss of smolts until reminded that over 90% of Snake River smolts had been transported.

5. Large screens have been placed in the inlets to the turbines in the dam. These screens divert the smolts to a channel within the dam that leads to an overhead non-pressurized channel from the power house to the juvenile fish facility, where the fish are processed at a separator that selects the fish according to tags and species. The fish are held in water fed raceways prior to loading on the barges or trucks within 48 hours. When fish numbers are large, direct loading into the barges bypasses the raceways.

6. There are three types of fish barges currently in use by the Corps. Two WWII (2000 series) fresh water barges were converted to start the fish barging operation in 1978. Two mid-size fish barges (4000 series) were constructed in 1981 and 1982 specifically for the fish transport program. In 1990, two super barges (8000 series) were added to the fleet, and in 1998 an additional two 8000 series barges were added.

7. The 2000 series barges are 130' long and 32' wide. They can carry 80,000 gallons of water in three holds (tanks). They have spray bars for oxygen generation, and degasify the water so the fish are transported at normal total dissolved gas (TDG) levels instead of the 120-125 percent levels that are currently employed by judicial decree. Each hold can carry 7500 lbs. of fish, for a total of 22,000 lbs. An average of 10 fish per lb = 220,000 fish. Barging requires two days to reach the release site below Bonneville Dam, with a documented survival rate of >98%. The round trip for the barges from Lower Granite dam (LGR) to the release site and back to LGR is a total of four days.

8. The 4000 series barges are 150 feet long and 34 feet wide. They have four holds, a 100,000 gallon capacity with aerators instead of spray bars. Each hold can carry 10,000 pounds of fish, for a total of 40,000 pounds of fish total, or 400,000 fish per trip. These barges have aerator stanchions where river water is pumped over a medium that re-oxygenates and degasifies the water entering the fish holds so the fish are transported at normal total dissolved gas (TDG) levels. The current action to spill and reduce the percentage of juvenile fish transported exposes the majority of these fish to harmful levels of TDG.

9. The 8000 series barges were patterned after the 4000 series with additional improvements. They have six fish holds, with a 150,000 gallon capacity, and 12,500 pounds of fish per hold for a total of 75,000 pounds of fish or 750,000 fish per trip. These barges also have similar water oxygenation and degasifying treatment systems to the 4000 series that provide normal TDG levels during their trip to the release site. These systems are monitored constantly all the way to the release site by Bio-techs with fishery degrees or experience in fish handling processes. Oxygen and temperature readings are taken every 2-4 hours, and any dead fish are removed from the holds and are identified and logged in to report documents on every trip.

10. The life support system on the eight barges is a flow-through type. River water is drawn into the barge sea chest and pumped via diesel-driven pumps. Water flows to the holds through spray bars or aerators, and returns to the river through over-flow drain pipes. The drain pipes are screened so no fish can escape the hold. Via this pumping method oxygenated water is supplied to Salmon and Steelhead smolts onboard. Under normal conditions, the incoming water, after passing through the spray bars or aerators, will be close to the saturation levels for oxygen.

11. Besides the addition of the aeration systems on the 4000 and 8000 series barges, a sophisticated alarm system called a (P-4) system was installed to alert the barge Bio-tech (Rider/Operator). It detects any failure or variation below accepted parameters to the

temperature or the oxygen levels required to sustain a healthy environment for the fish. When an alarm sounds the Rider can make corrections as necessary. Adult returns data (#1) show that barging fish is one of the better tools in the arsenal on documented smolt survival.

12. In the lab at the Juvenile Fish Facility (JFF) a sampling program that is conducted by biologists at every loading of the barges includes the identification of species, scaling condition of smolts, size and weight, and general health. This program is observed and recorded by contracted independent fisheries Agencies that oversee the operations at every area. University personnel are also engaged in research operations in the lab area.

13. Spilling more water to move migrating salmonids through the system instead of barging, increases the Nitrogen saturation level to a lethal environment for the fish. Barging can reduce the Total Dissolved Gas (TDG) to safe levels, and insure more Salmon and Steelhead smolts reach the estuary in a safe and timely manner on their outward migration.

References:

A. Credits to personnel at USGS and The Juvenile Fish facility at Lower Granite Dam. Documentation of Juvenile Fish Facility Barge operators training manual 2021.

B. (#1) Fish Passage thru the Lower Snake River Dams and Columbia Rivers. Walla Walla District. U. S. Army Corps of Engineers, June 17, 2020

C. www.Snakeriverdams.com information on the benefits of barging fish.

D. Review by John McKern, Fish Passage Solutions, LLC

CPFD

Biography for Dan Caldwell

Dan earned an AA degree at Shasta College in Redding CA, a B.S. degree in Production Agriculture from Chico State University and an M.S. degree in Extension Education from Washington State University (WSU).

Dan is currently a resident of Idaho and retired from Washington State University (WSU) in 2003, where he managed a 2,700-acre farm and animal operations for the Animal Sciences Dept. He also assumed the responsibility as the University Compost operations Manager in October 1994. The WSU compost facility was the first University in the nation to develop and operate a comprehensive campus wide organic composting program. The program won many awards and continues to be a model program for the composting industry.

Dan is a Certified Compost Facility Operator (CCFO) and has been involved with compost pesticide contamination issues since 2000. He was a member of the Washington State Dept. of Agriculture, Compost Pesticide Advisory Committee, the Washington Organic Recycling Council, and the U. S. Composting Council. Dan was the Asotin County compost coordinator in 2010-2011 and held summer workshops at the Clarkston City garden. Dan also did a tour in Taiwan for the U. S. Grains Council.

In 2004 Dan became involved with fisheries research as a Biological-technician (Bio-tech) with the U.S. Geological survey (U.S.G.S), At the Columbia River Research Lab in Cook WA, Dan was trained in smolt tagging, fish ID, and boat operation. Dan worked at many dams the next eight years installing fish telemetry receivers, dam tail-race boat, GPS recovery spill research, smolt release operations for out migration research, and other requirements regarding smolt research.

When funding was cut, Dan was hired by the Army Corps of Engineers (ACE) as a fish transport barge rider/operator. Dan prepared and maintained barges and was responsible for the safety of Salmon and Steelhead smolts as they passed the remaining seven dams to the estuary below Bonneville dam. For the next five years Dan transported millions of smolts in a healthy, acclimated water environment free of predation and time delays. When barging was completed each season, Dan worked in

the separator at the Juvenile Fish Facility at Lower Granite Dam continuing the fish monitoring process at the facility.

Dan joined the Citizens for the Preservation of Fish and Dams in 2022 as a resource about fish transportation, predation issues and Dam improvements for fish benefit.

His outside interests include hunting, fishing, boating, camping, Sporting clay and skeet shooting, singing, guitar playing, and spending time with his grandkids.