

NUTRIENT RESTORATION PROGRAM – FREQUENTLY ASKED QUESTIONS

The Nutrient Restoration Program (NRP) has been in existence in the Kootenay region since the 1990s. Nutrient additions are made to both Kootenay Lake and Arrow Lakes Reservoir.

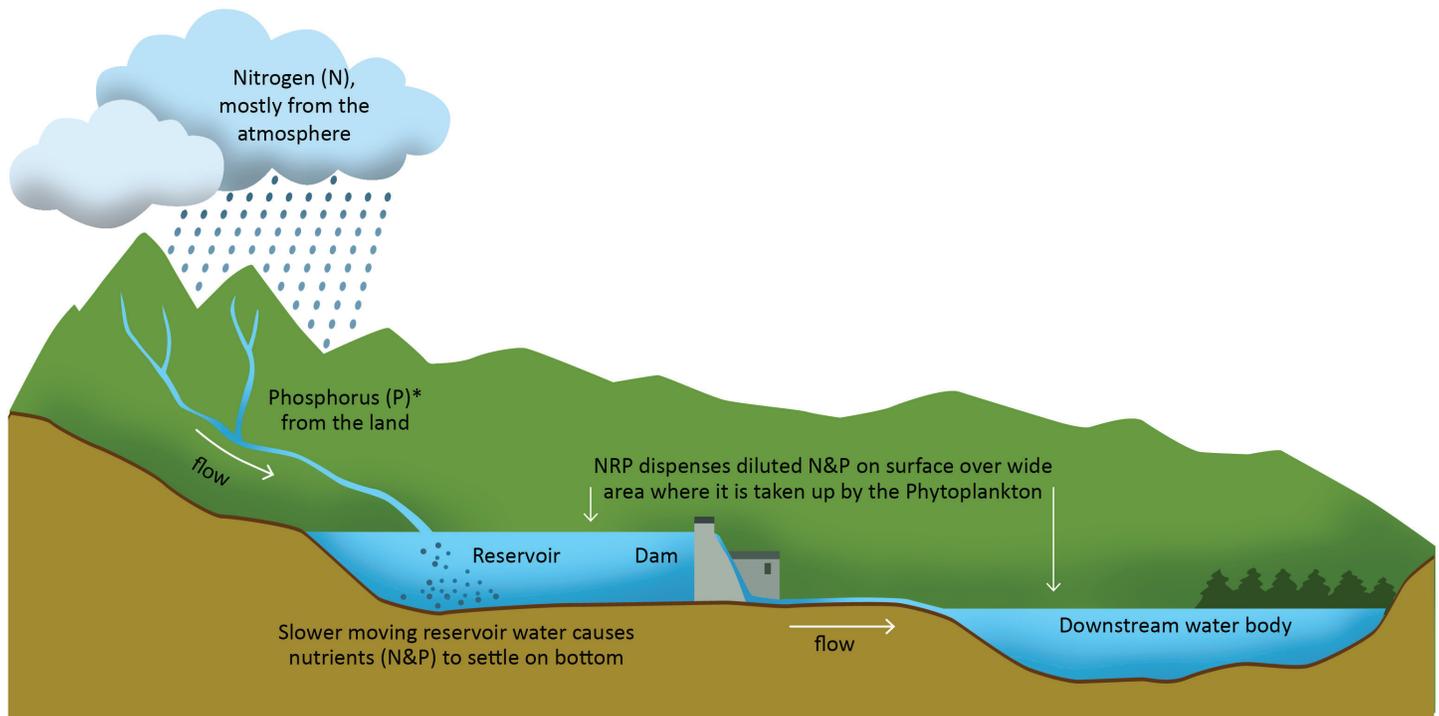
WHEN DID IT START AND WHY?

This experimental program started in the 1990s to restore the food web impacted by the construction of dams and creation of reservoirs in the West Kootenay. Some key dates:

- 1992: started on the North Arm of Kootenay Lake due to impacts from Duncan Dam.*
- 1999: expanded to Arrow Lakes Reservoir in response to the impacts from Revelstoke* and Mica* dams.
- 2004: expanded to the South Arm of Kootenay Lake as a result of the impacts of Libby Dam.**

*BC Hydro dams **US dam

The resulting reservoirs can act to settle out natural nutrients (both phosphorus and nitrogen) that would otherwise flow downstream. Kootenay Lake and Arrow Lakes Reservoir became nutrient depleted and kokanee stocks decreased. By the 1990s, both water bodies became “ultra-oligotrophic,” meaning poorly nourished. The Nutrient Restoration Program replaces the nutrients that would otherwise be flowing into these water bodies.

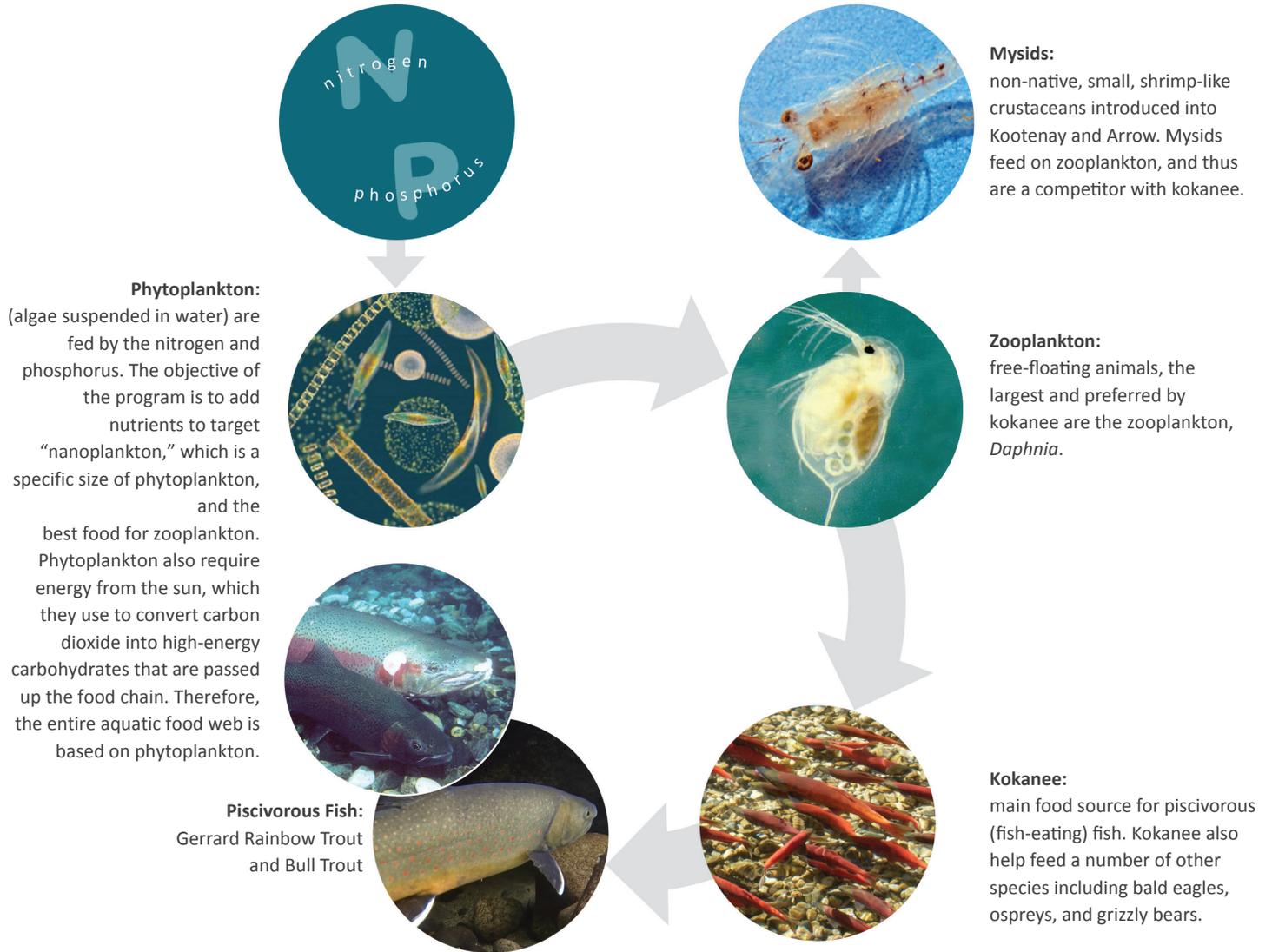


* Phosphorus can also come from agricultural run-off and septic systems

WHAT IS PUT INTO THE WATER – IS IT FISH FOOD?

It is not “fish food” but essential nutrients consisting of a liquid blend of nitrogen and phosphorus that feed the smaller, microscopic life forms in the water. The phosphorus source is liquid agricultural grade ammonium polyphosphate (10-34-0) and the nitrogen source is liquid agricultural grade urea ammonium nitrate (28-0-0).

ADDING NUTRIENTS TO THE FOOD WEB



WHY NOT KEEP ADDING NUTRIENTS TO INCREASE FISH NUMBERS?

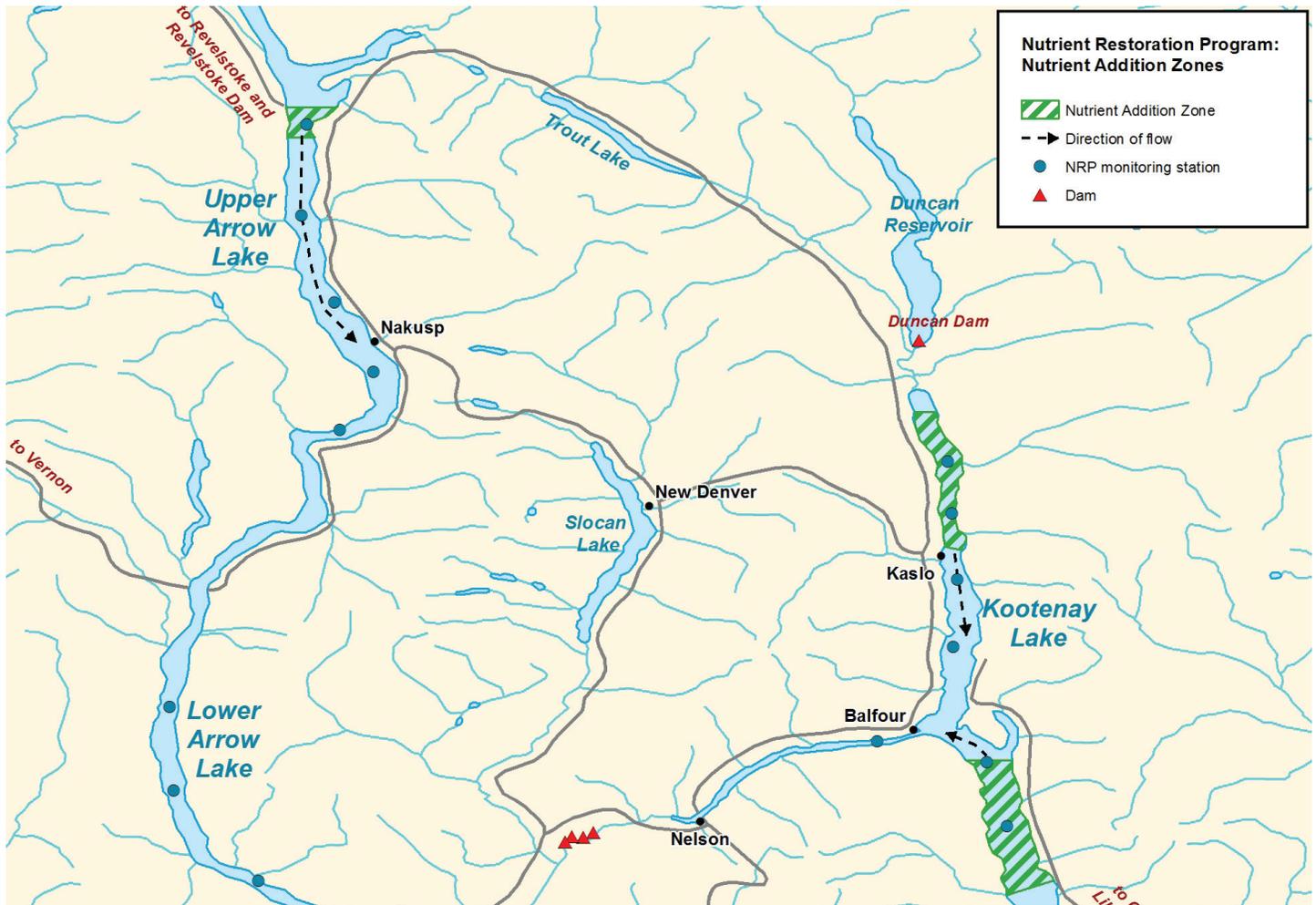
Implementation of the Nutrient Restoration Program is a balancing act. Adding too many nutrients can lead to over-enriched bodies of water that produce too much algae. As these algae die, they use oxygen to decompose, which is unhealthy for fish, plants and other animals. As well, not all algae are edible to zooplankton.

IS IT SUCCESSFUL?

The Nutrient Restoration Program is successful; by adding nutrients, the food conditions for kokanee have improved. While there have been some variations in results, zooplankton biomass, particularly *Daphnia* (the preferred food source to kokanee) has increased. As a result, kokanee biomass in both Kootenay Lake and Arrow Lakes Reservoir has increased 2.5 times over the duration of the Nutrient Restoration Program.



Photo: Brian Sperling



WHEN AND HOW IS IT DISPENSED?

Nutrients are dispensed from spring to early fall, where the amounts are seasonally adjusted. More phosphorus than nitrogen is added in the spring and, as the summer progresses, more nitrogen than phosphorus is added. In-season results also drive the amount of nutrients added to maintain the balance of nitrogen to phosphorus, in order to grow the optimal size of phytoplankton.

The nutrients are either driven onto a ferry or loaded onto a barge and taken to the Nutrient Addition Zones. Nutrients are dispensed using dispersion bars that spray the nutrients on the surface of the water into the propeller wash. The product is denser than water, so it is important that it is well-mixed.

WHAT DO YOU MONITOR?

To ensure there is an efficient uptake of the nutrients, an adaptive management technique is used. This means water quality monitoring is conducted monthly from April to November (twice in June, July and August), so that the amount of nutrients added can be adjusted accordingly. There are a total of 16 monitoring sites; eight in Kootenay Lake (including one in the West Arm) and eight in the Arrow Lakes Reservoir. Monitoring includes temperature, water chemistry, phytoplankton, zooplankton and mysids. In-lake kokanee abundance is estimated through hydro-acoustic and trawl sampling. Kokanee spawner enumeration occurs in various tributaries in both Kootenay and Arrow, as well as the spawning channels located on each system. Bull trout redd counts are also monitored on select tributaries in Kootenay and Arrow. A survey on anglers is also conducted several times a month from January to December on Arrow Lakes Reservoir.

DOES THE NRP FEED MYSID SHRIMP?

That is not the intention. Mysid shrimp are a non-native species introduced into Kootenay Lake in 1949, and to Arrow Lakes Reservoir in 1968, as a food source for juvenile rainbow trout. In the years that followed, an increase in size of kokanee in the West Arm was mistakenly attributed (for a variety of reasons) to the introduction of the shrimp and, as a result, mysid shrimp was introduced into many lakes across North America and Scandinavia. Although some are eaten by kokanee, the reality is that mysid shrimp compete with kokanee for zooplankton, rather than provide a food source for them in Kootenay and Arrow. Mysid shrimp are able to avoid predation by spending the day in deep, dark water. They migrate at night to the surface waters to feed on zooplankton, thus competing with kokanee for food. There were initial concerns that the restoration of nutrients would lead to significant increases in mysid shrimp populations that would out-compete the kokanee, but this has not been the case. Also, in a scenario of low kokanee and high zooplankton, the abundance of mysid could increase; these results have not occurred to-date.

ARE NUTRIENTS A PROBLEM?

In parts of Canada, too many nutrients are a serious concern, where blooms of algae deplete a waterbody of oxygen and release toxins. Lakes and rivers affected are typically shallower, warmer and naturally high in nutrients. Problems occur when these water bodies receive large amounts of nutrients from agricultural runoff, sewage plants or industrial effluents.

Kootenay Lake and Arrow Lakes Reservoir are large, cold and naturally lower in nutrients. The restoration of nutrients to a level pre-dating the dams, adds a balance of nutrients over a wide area at specific times of the year, and the process and results are carefully monitored to ensure a healthy ecosystem.

DOES IT AFFECT MY SWIMMING AND SHOULD I WORRY ABOUT WATER QUALITY?

The Canadian Water Quality Guidelines for the Protection of Aquatic Life and the Protection of Drinking Water for Humans contain regulations for the amounts of nitrogen and phosphorus permitted in water. Nutrients and other water quality parameters (such as metals) are measured and concentrations during the NRP remain below those permitted by such regulations.

WILL THERE BE A TIME WHEN THE NRP IS NOT NEEDED?

In the late 1990s the level of nutrients added (phosphorus and nitrogen) to Kootenay Lake was decreased to see if the lake had retained enough to maintain kokanee stocks. This was not the case and there was a subsequent decrease in phytoplankton and zooplankton densities and kokanee numbers. There are currently no plans to cease the program, although biologists are always exploring ways to improve the efficiency of the nutrient up-take in the ecosystem.

WHO PAYS?

On Kootenay Lake, the North Arm NRP is funded by the Fish & Wildlife Compensation Program (FWCP), BC Hydro through its Water License Requirements (WLR), and in-kind support comes from the Province of B.C. The South Arm NRP is funded by the Kootenai Tribe of Idaho (KTOI) that receives funding from the Bonneville Power Administration, through the Northwest Power and Conservation Council's Columbia Basin Fish and Wildlife Program.

On Arrow, the NRP is funded by the FWCP, Columbia Power and in-kind support comes from the Province of B.C. and Waterbridge Ferries Inc. Columbia Power contributes 25% annually to assist with the program. Funding is provided by Arrow Lakes Power Corporation (ALPC), which owns the Arrow Lakes Generating Station. ALPC is jointly owned by Columbia Power and Columbia Basin Trust. Columbia Power manages the operations of the ALPC on behalf of the joint venture. The funding is being provided as a compensatory benefit for the operations of the Arrow Lakes Generating Station.

To see the cost of the Nutrient Restoration Program for the current fiscal year, visit fwcp.ca.

WHO COORDINATES THE PROGRAM?

The Province of B.C. (Ministry of Forests, Lands, Natural Resource Operations and Rural Development - FLNRORD) is responsible for overall coordination of the Nutrient Restoration Program. Together with FLNRORD, the FWCP coordinates the NRP in the North Arm of Kootenay Lake and Arrow Lakes Reservoir. FLNRORD also delivers a complimentary NRP in the South Arm of Kootenay Lake, in partnership with the Kootenai Tribe of Idaho.



Photo: Ministry of Environment

WHAT IS THE FWCP?

FWCP is a partnership between BC Hydro, the Province of B.C., Fisheries and Oceans Canada, First Nations, and Public Stakeholders to conserve and enhance fish and wildlife in watersheds impacted by BC Hydro dams. In the Columbia Region, the FWCP has a long-term agreement with the Province of B.C. to coordinate its ongoing, core projects, such as the operation of the Kokanee spawning channels and the Nutrient Restoration Program. For more information visit fwcp.ca.



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