Idaho Department of Fish and Game

Dworshak Reservoir Quarterly Report

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January, February, March, 2005

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Figure 1. Spawning adult kokanee in Isabella Creek.

Points of Interest:

- Low detection rate despite increased discharge. Highest fish detection during dawn followed by nighttime periods.
- Reservoir productivity stable or reduced since 1990 sampling.
- Average total zooplankton densities peaked in June, 2004 at 32/liter.
- Zooplankton community dominated by copepods.
- January kokanee densities near dam remain fairly high yet lower than densities seen in fall 2004.
- Preparation of strobe light installation plan slated for next quarter.

Kokanee Entrainment Assessment

The U.S. Army Corps of Engineers increased discharge through the turbines several times this quarter for increased power production. Typically dam operations maintain a minimum discharge of 1,400 cubic feet per second (cfs) through a single turbine during the winter. Yet, these changed operations allowed us to sample in front of turbine intakes two and three and at higher discharges.

Our on-going entrainment monitoring provides basic information on the number of detected fish immediately in front of operating turbines and reservoir outlets (ROs), representative of loss of fish through intakes and out of the reservoir (entrainment). Fish are detected with a fixed location sonar beam as they move into or near respective turbine intakes. This information helps to predict the degree of variability in fish entrainment expected between time of day, seasons, discharge rate, and intake openings.

Table 1. Turbine intake, discharge rate, and detection rate of fish obtained from fixed-site hydroacoustic sampling, September, 2004—January, 2005.

Date	Turbine #	Discharge (cfs)	Detection (fish/hr)
9/27/04	2	1,600	9.1
10/4/04	1	1,600	21.5
10/18/04	1	1,600	28.0
10/19/04	1	1,600	40.8
1/10/05	3	5,500	0.2
1/25/05	3	5,500	0.6

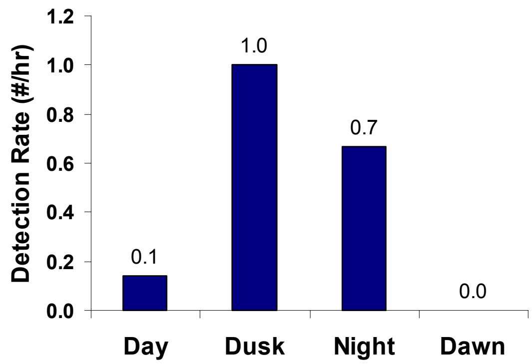
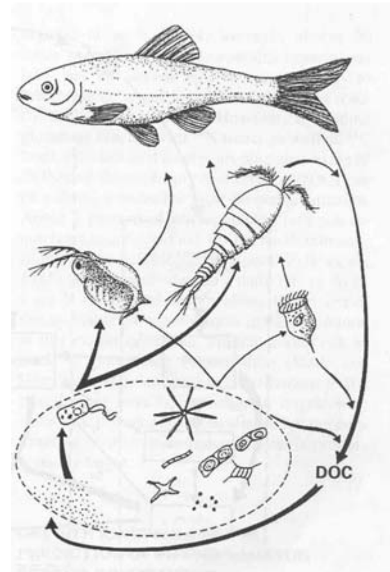


Figure 2. Average fish detection rate (#/hr) in front of discharging turbines for each of four time of day strata, obtained from fixed-site hydroacoustic sampling in front of turbine 3 during January, 2005.

We sampled two 24 hr periods in January. Three additional 24 hr sample periods were also sampled during this quarter, but this data have not yet been analyzed. Very few fish were detected in January, especially compared to what we found in September and October of 2004 (Table 1). The detection rate was low despite sampling during higher discharge.

Again, more fish were detected during night than day periods, however more fish were detected during dusk periods than during dawn periods, which is opposite what we found in September and October (Figure 2).

Dworshak Reservoir productivity (limnological) survey



Last spring we started monthly limnological sampling throughout Dworshak Reservoir (see 2nd quarter report, 2004). Eleven limnological stations were sampled monthly from May through November. This research is being conducted to assess the relationship between the kokanee population and nutrient concentrations in Dworshak Reservoir. Specifically we want to re-evaluate how changes in reservoir productivity (nutrients and zooplankton) influence annual kokanee population stability (density, length-at-age, growth, and survival), especially compared to historic data. Kokanee feed exclusively on zooplankton (microscopic crustaceans) in the pelagic area (open water) of the reservoir, and zooplankton feed on phytoplankton, which rely on nutrients in the water.

A total of ten limnological stations were sampled monthly from May through November. Three stations were sampled in each of three sections of Dworshak Reservoir (lower, mid, and upper-reservoir). At each station, dissolved oxygen, turbidity (water clarity), and temperature measurements were taken with a water quality meter. In addition, zooplankton were sampled with a plankton net and water samples were collected using a Kemmerer bottle. Water samples were analyzed for nitrate nitrogen (NO_3); orthophosphorus (OP) and total phosphorus (TP); and chlorophyll *a*. In the laboratory, zooplankton were identified, counted, and recorded as organisms/liter of water sampled.

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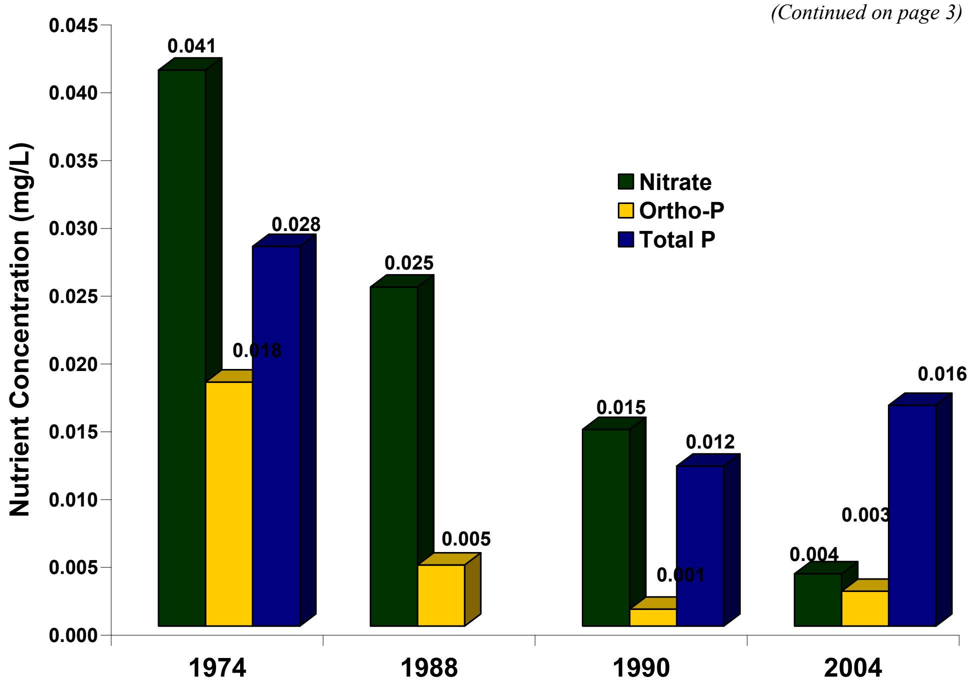
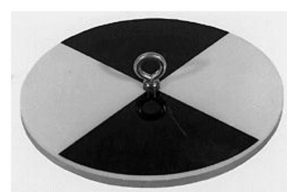


Figure 3. Comparison of nitrate, ortho-phosphorus, and total phosphorus nutrient concentrations (milligrams/liter) in Dworshak Reservoir, from limnological sampling 1974, 1988, 1990, and 2004.



Dworshak Reservoir productivity survey (continued…)

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Nutrient concentrations were generally higher than we expected yet still relatively low. It is widely known that reservoirs are typically very productive during their first few years after filling then become increasingly sterile with age, which had been observed in previous sampling on Dworshak; however, limnological samples had not been collected since 1990. Our values are fairly typical of oligotrophic (nutrient poor) reservoirs in the west, although more enriched than the very sterile waters of Lake Pend Oreille for example. As expected reservoir nutrients have continued to decrease or have stabilized (Figure 3). Average nitrate (NO_3) concentrations decreased from 0.015 mg/L in 1990 to only 0.004 in 2004. Both ortho-phosphorus (OP) and total phosphorus increased slightly; however, these values are very near our laboratory detection limits. Therefore, these values could actually have been considerably lower, since values reported at the detection limit were used in averaging.

Average total zooplankton density peaked during June (32 zoop/L) and was lowest in November (17 zoop/L); (Figure 4). Copepods, primarily Cyclops and Ergasilus, dominated the zooplankton community by density throughout most of our sampling, but especially during June and November. However, kokanee prefer large Cladoceran zooplankton, primarily Daphnia and Bosmina, which were found in slightly greater densities than Copepods during July and August.

In the future, we also hope to incorporate age-at-length, growth, and density data with additional data on kokanee food habits and caloric intake data to allow us to predict kokanee population dynamics with changes in productivity and zooplankton density.

Zooplankton sampling net

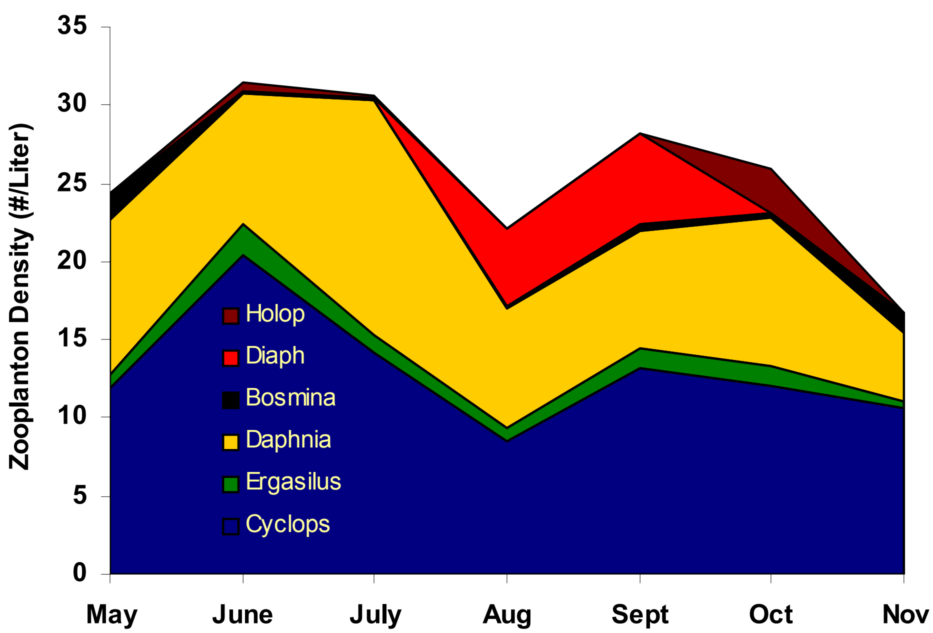

Figure 4. Average density of zooplankton (number/liter) in Dworshak Reservoir, from limnological sampling May-November, 2004. Graph depicts each zooplankton group's contribution to the mean total zooplankton density averaged from nine sites for each month. Note: Holop = *Holopedium sp.*, Diaph = *Diaphanosoma sp*.

Bosmina

Daphnia

Kokanee Densities near the Dam

We continued monthly hydroacoustic surveys within the forebay area of the reservoir (near the dam), to determine the time of the year most critical for kokanee entrainment losses as well as determine when kokanee densities are high enough to feasibly test or operate strobe lights.

Fish densities near the dam were substantially higher than last surveyed in January and February, 2003 (Figure 5). Densities in January and February reached 215 and 217 fish/acre respectively, more than 4-5 times higher than in 2003, the last time surveyed.

Trawl sampling in October and November, 2004 revealed a very abundant fry year-class which comprised the majority of kokanee captured. Therefore, these fry can likely be attributed to the increased kokanee densities in October and November, which appear to have held over in the forebay into January and February as well.

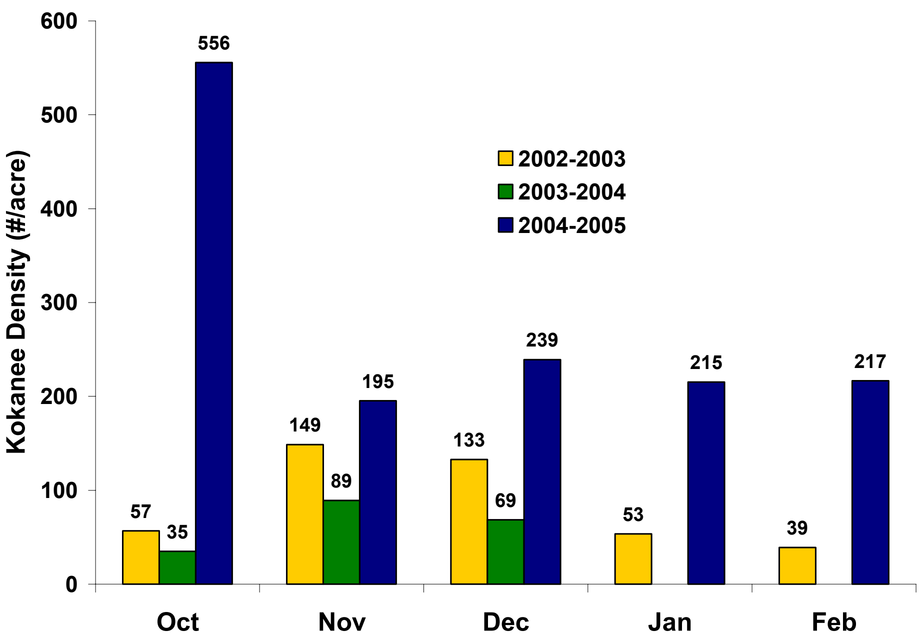

Figure 5. Average kokanee densities (#/acre) in the forebay of Dworshak Dam, Idaho; obtained from monthly hydroacoustic sampling, October - February, 2002 - 2005.

Next Quarter's Activities

During the next quarter, we will continue entrainment assessment sampling. We will finish writing the 2003 annual report and continue analysis and interpretation of entrainment echograms.

We will also be preparing a recommendation plan to permanently install underwater strobe lights as a measure to reduce fish entrainment through Dworshak Dam. This plan will be submitted to the U.S. Army Corps of Engineers, whom we're hoping will find funds and resources to implement this technology we've proven to be an effective deterrent to fish entrainment.

Lastly, we will be installing a wireless ethernet system on Dworshak Dam. This system will allow us to control the echosounder and transducer (sonar), and transmit the data collected during entrainment sampling by the echosounder to a data collection computer over a mile away at our Ahsahka field office.

Internet Links to more info:

Are you looking for past quarterly and annual reports concerning Dworshak Reservoir research?

They can be found on Idaho Fish and Game's website at (**http://fishandgame.idaho.gov./tech/reports/**). Click on the **Fisheries** link, type '**Dworshak**' into the space to the right of the magnifying glass on the upper right of the screen, and click on the 'Go' button.

Questions and comments on Dworshak Quarterly reports should be addressed to:

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