Burbot – Not just another cod

Dedicated citizens and scientists in the United States and Canada are developing spawning and early rearing techniques to save this unique endangered freshwater fish.

BY NATHAN JENSEN AND KEN CAIN

North American burbot (Lota lota maculosa) populations have declined rapidly in the Kootenai(y) River and Kootenay Lake regions of Idaho, USA and British Columbia, Canada. This stock of freshwater cod has traditionally sustained valuable social, economic and sustenance fisheries for Native Americans in the region and provided sport and commercial fishing opportunities until stocks collapsed in the 1970s and 1980s. The Kootenai Tribe of Idaho (KTOI) along with the Kootenai Valley Resource Initiative (KVRI) and concerned citizens have initiated efforts to re-establish burbot in this system.

A conservation strategy was developed by the Burbot Subcommittee of KVRI and aquaculture was identified as a key component to rebuild a harvestable population. Initial experimental scale efforts were carried out at the KTOI Fish Hatchery and later expanded to the University of Idaho’s Aquaculture Research Institute (ARI) in 2003. Spawning, semen cryopreservation, egg incubation and larval weaning techniques have been evaluated and continue to be optimized.

As with most species with a distinct larval stage, weaning from live prey to formulated feeds is challenging but production of feed-trained burbot has occurred annually since 2003. In addition to intensive methods, semi-intensive and extensive culture practices are being developed.

Broodstock rearing

Broodstock rearing and spawning occur in a 20,000L recycling system designed to maintain 3°C during spawning season (February-April) and 10-15°C during the off-season. Photoperiod and water temperature are adjusted to mimic the Kootenai River down to 3°C where it is held until river temperatures begin to increase. The water supply consists of 15-19°C municipal water pre-filtered with fluidized carbon, trickled through a degassing column and aerated before entering the system. Additionally, sodium thiosulfate is used to neutralize residual chlorine. Recycled water flows through two fluidized sand beds and one fluidized...
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carbon filter before being chilled, exposed to UV, and aerated upon entering the rearing system tanks. Wild caught adult broodstock (40-50; 2.5kg average body weight) are maintained in the system year-round and fed rainbow trout (Oncorhynchus mykiss; 10-40g average body weight). Standard veterinarian ultrasound technology is used to verify gender and monitor gonad development prior to spawning.

Spawning process

Fiberglass tanks (1300L) fitted with 500micron screened outflows are used during spawning season to prevent egg loss due to volitional (in tank) spawning. Adults are checked for ripeness weekly and spawned manually if possible. Volitionally released eggs are collected by removing adults from the rearing tanks, allowing the eggs to settle and then siphoning them out. Exogenous hormone analog and gender segregation trials have shown adults release gametes volitionally with or without hormone. Additionally, semen cryopreservation trials were performed and showed methanol concentrations in semen freezing extender of 10 or 20% increased motility and fertilization compared to 5%. These trials verified that previously reported methods with European burbot (Lota lota lota) work reliably with our Southern BC broodstock.

Egg incubation

Egg incubation occurs at 2-5°C by recycling water through a series of four 1HP chiller units with a maximum inflow rate of 40L/min of treated municipal supply water. Water leaving the chilling system then flows through incubators and leaves the system. Incubation trials revealed that 1-2L conical incubator jars work better than 6L McDonald type jars at flows of 250-500 mL/min. Low flows are required to retain the 1mm semi-buoyant eggs within the incubators and accommodate stocking densities of approximately 300,000 eggs/L. Fungus development on eggs has been a problem and both formalin and hydrogen peroxide have been used for control. Egg masses also have been observed to become adhesive during incubation.

Hatching typically begins 35-40 days post-fertilization or 130 degree days on average. Eggs within a mass have been observed to hatch over a 40 day period at 2°C unless incubation temperatures are increased as hatching occurs. Larvae (3-4mm) hatch and collect in 250L black plastic tanks plumbed with three separate inflow lines that supply water to incubators prior to hatch.

Post hatch

After hatching is complete, two inflows are used to disrupt water surface tension for swim bladder inflation and the third introduces water near the bottom of the tank. In addition, a bubble ring is plumbed at the base of the outflow screen to help disrupt surface tension, repel larvae away from the outflow and create a current for uniform feed and larvae distribution. It takes 10-20 days for larvae to develop a mouth, alimentary tract and begin exogenous feeding. A live diet is required at the onset of exogenous feeding and begins with “L-type” brackish rotifers (Brachionus plicatilis); followed by decapsulated “GSL” Artemia nauplii hatched in 5 gal water containers.

Weaning trials at the ARI showed that the earliest they could wean larvae onto a formulated diet was after 30 days on live feeds or approximately 45 days post hatch. However, prolonged Artemia feeding beyond 30
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Nathan Jensen and Ken Cain are with the Department of Fish and Wildlife and the Aquaculture Research Institute, University of Idaho, Moscow, ID 83844-1136, USA. For additional information contact Dr. Ken Cain at kcain@uidaho.edu

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Collecting spawned eggs. Photo courtesy of Jimmy Barron

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