

# Conservation aquaculture: a critical tool for recovery of burbot in the Kootenai River



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# Burbot aquaculture development

## Outline:

1. Background
2. Present the status of burbot in the Kootenai River
3. Program goals, objectives, and results
  - Phase I, II, III
  - Highlight releases of hatchery burbot in BC Canada and Idaho



# Biology

## Only freshwater Gadiform

- Indirect life-history strategy  
“larval form exists”

## Adult form - maturity 3 - 4 years

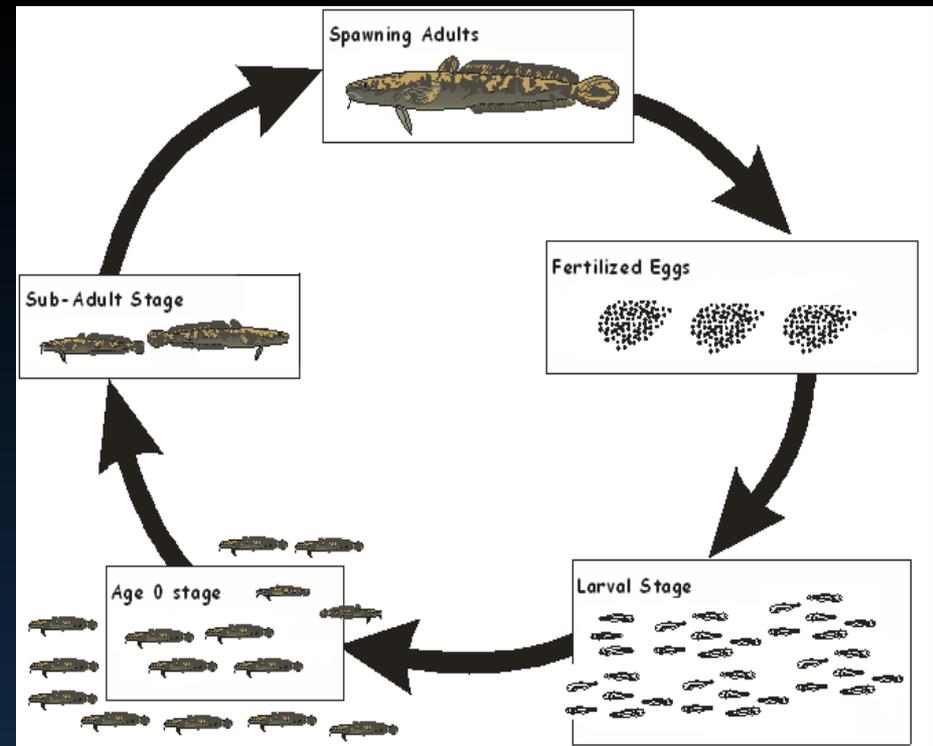
- Communal, nocturnal, winter spawning
- Piscivore

## Eggs

- 1mm, semi-buoyant
- Hatch @ 112-200 degree days

## Larvae

- 3-4 mm at hatch
- Hatch w/o mouth
- planktivore



1 mm diameter

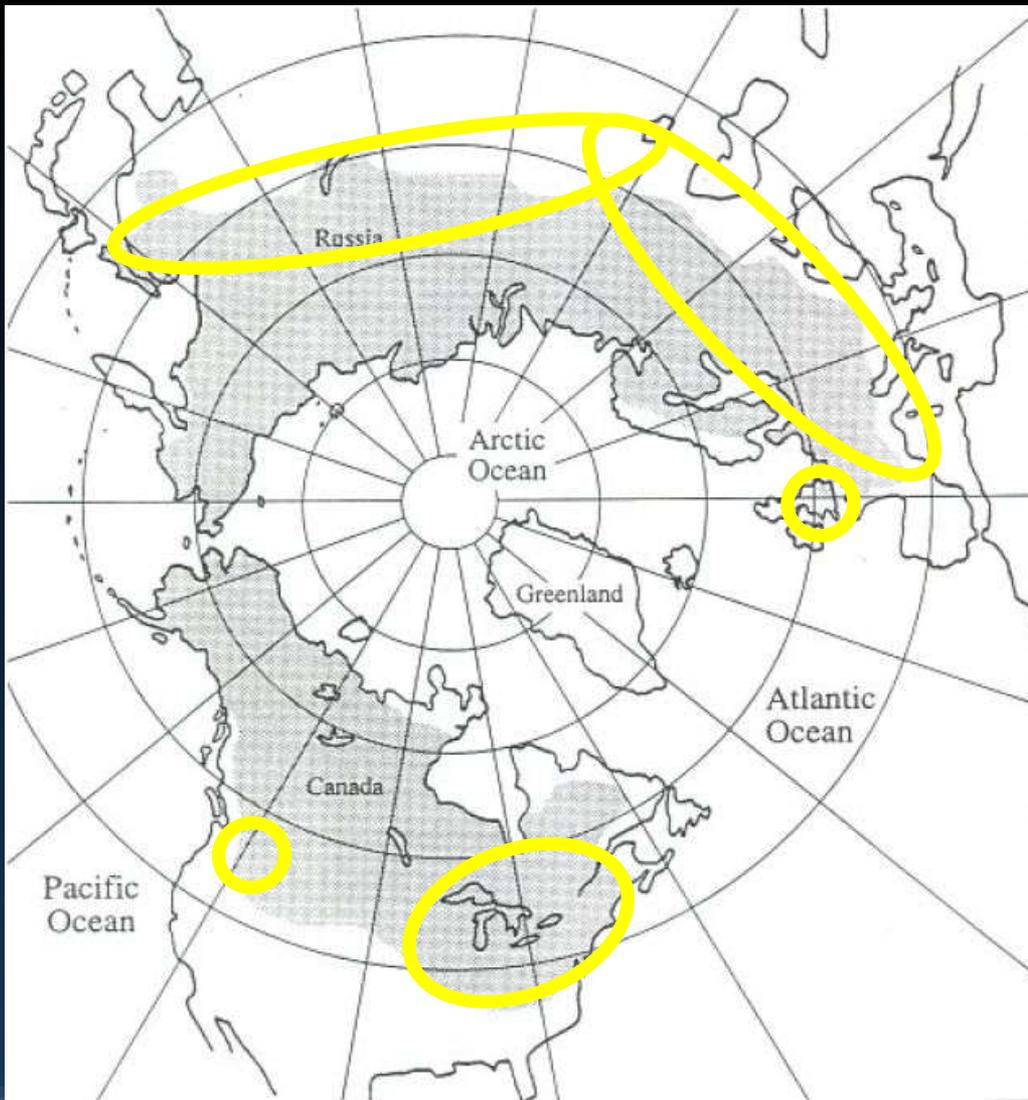


# Burbot Life History

- High fecundity – can exceed 3 million eggs
- Broadcast spawning



# Status of Burbot Worldwide

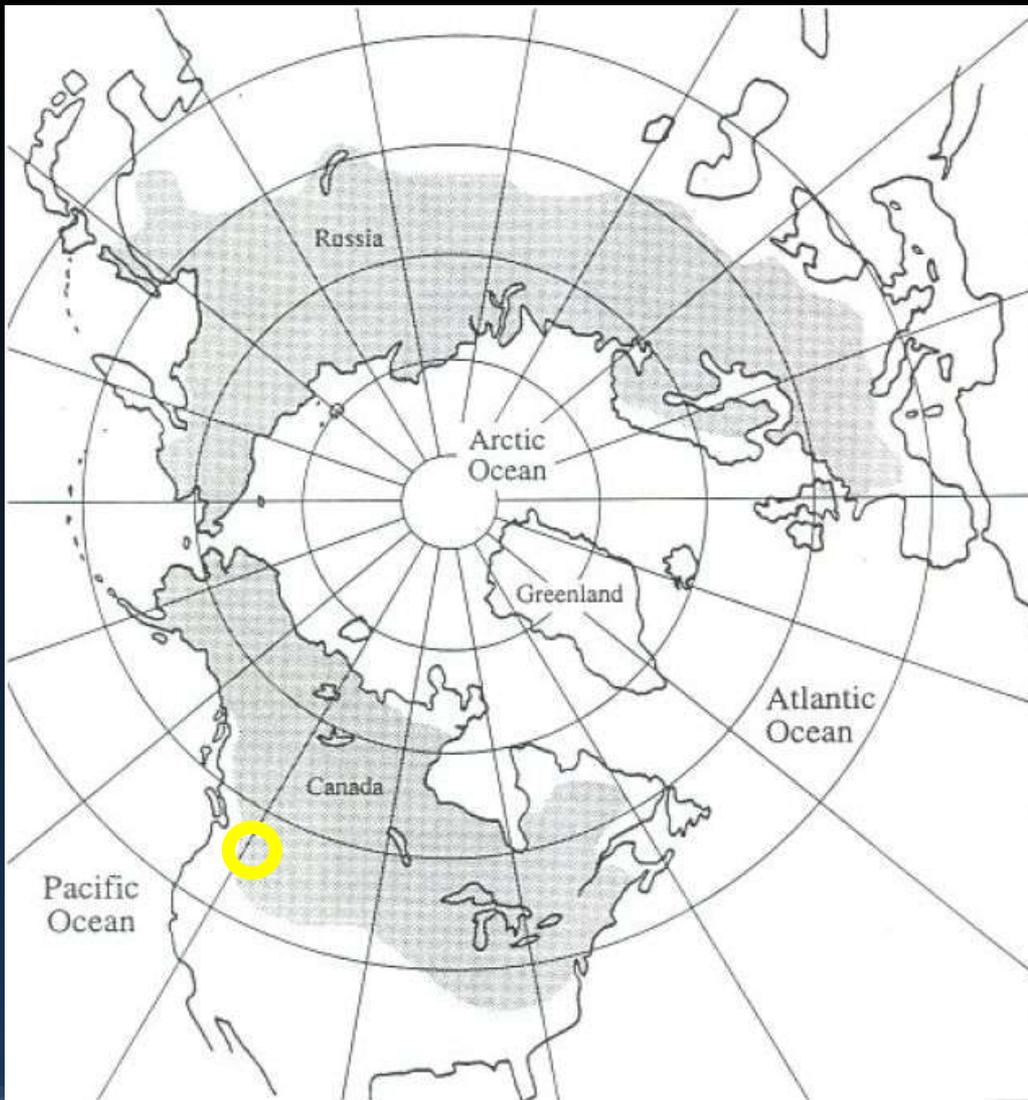


(adapted from McPhail 1997)

- Populations declining at southern latitudes & developed regions
- Extirpated in the UK & parts of W. Europe
  - Habitat alteration
  - Pollution
  - Invasive species
  - Climate change
  - Mismanaged fisheries

(Stapanian et al. 2010)

# Burbot in Idaho: The Lower Kootenai River



- Population imperiled
- IDFG estimate:  
< 100 adult burbot

## Habitat alterations

- Libby Dam (1975)
- Dikes/River channeling
- Floodplain degradation
- Water temperature

# Kootenai River Burbot Status:

- Burbot in the Kootenai River are functionally extinct.

## Collapse of Burbot Fisheries in the Kootenai River, Idaho, USA, and Kootenay Lake, British Columbia, Canada

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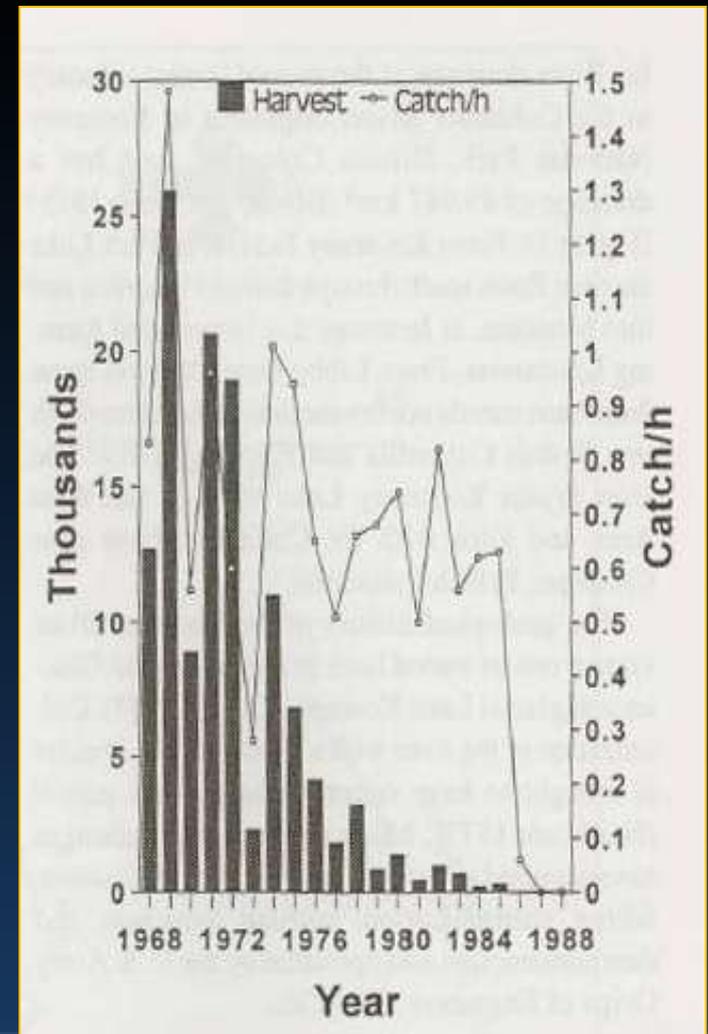
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## Population Dynamics and Extinction Risk of Burbot in the Kootenai River, Idaho, USA and British Columbia, Canada

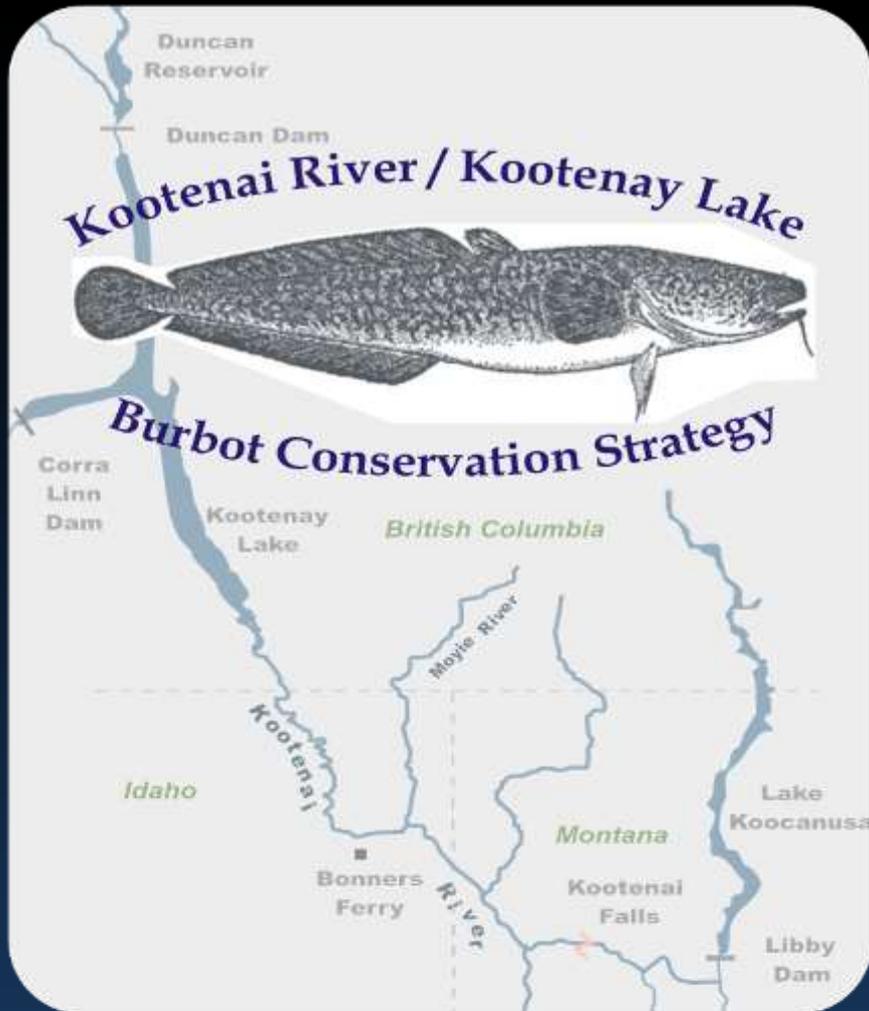
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# Burbot Restoration in Idaho



(Photo courtesy of Kootenai Valley Resource Initiative)

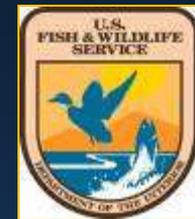
## Goal

Restore a viable, self-sustaining, harvestable population in the Lower Kootenai River

\*signed by 16 agencies and entities in 2005



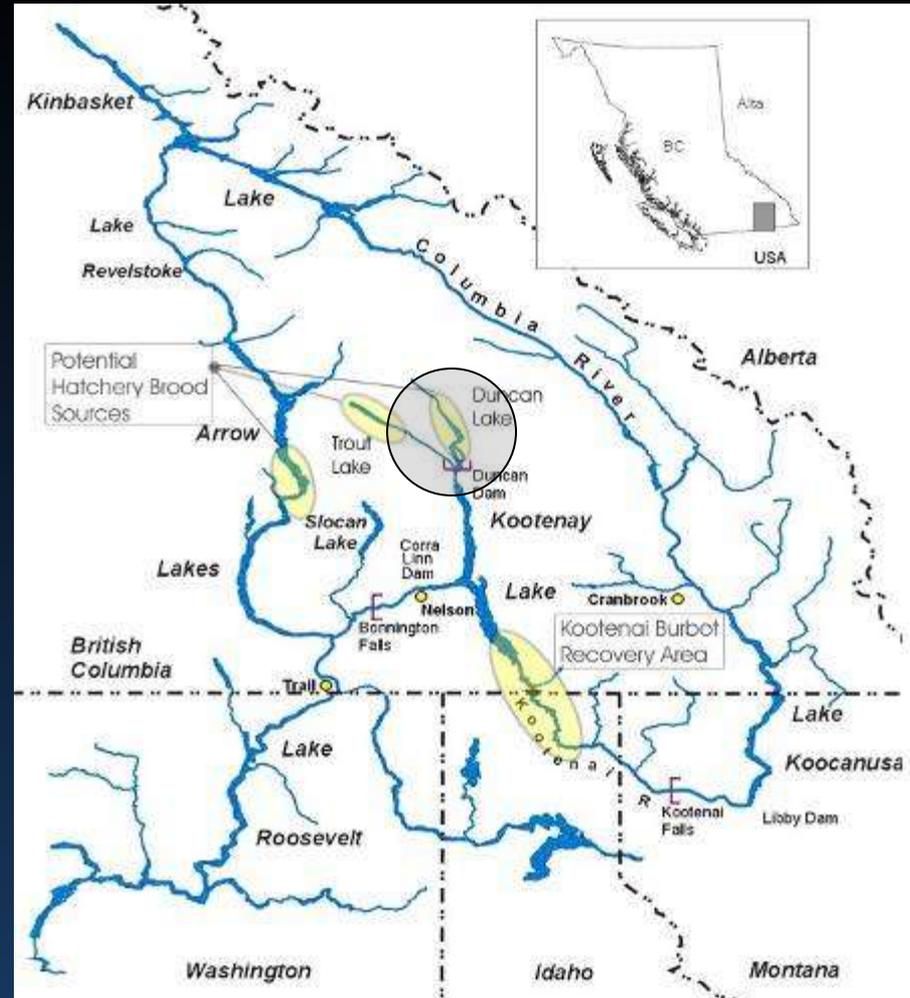
University of Idaho



# Burbot Conservation Aquaculture

## Initial efforts:

- Capture wild fish (November 2003)
- Transport to UI (ARI)
- Transitioned to captivity mimicking N. Idaho photoperiod and temp. profile



# Burbot Conservation Aquaculture

- Wild gamete collection from Moyie Lake, BC



(Photos courtesy of KVRI)



# Burbot Aquaculture at UI

- Egg incubation
- Larval rearing
- Juvenile grow-out



# Phase I:

## Program Objectives:

1. Test spawning methods
2. Apply/develop semen cryopreservation techniques
3. Evaluate incubation methods
4. Develop larval and juvenile feeding strategies



Burbot broodstock captured 2003



Burbot egg incubation



Eggs and larvae



Commercial feed transition

# Primary Program Results:

- Captive breeding and rearing of Burbot was feasible!

## Preliminary Captive Burbot Spawning Observations

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## Evaluation of Egg Incubation Methods and Larval Feeding Regimes for North American Burbot

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## Cryopreservation and Methanol Effects on Sperm Motility and Egg Fertilization in Burbot

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# Phase II of program

## Secondary Objectives:

1. Optimize and improve incubation/larval rearing methods
2. Characterize disease risk and susceptibility for species
3. Investigate alternative rearing methods – pond “semi-intensive”
4. Initiate experimental releases



# Second phase of program:

## 1. Optimize egg incubation methods

- Use of 1500 ppm Formalin or 500 ppm Hydrogen Peroxide recommended to control fungus



50 ml centrifuge tube incubators used, 5000 eggs

Incubator Fungi example

### Assessment of Formalin and Hydrogen Peroxide Use during Egg Incubation of North American Burbot

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Polinski et al., 2010. North American Journal of Aquaculture.

# Second phase of program: (Larval Feeding Challenges)



**Rotifers**



**Artemia**



**Marine larval fish diet**



# Second phase of program:

## 2. Characterize burbot susceptibility to five pathogens:

- Burbot appear susceptible to IHNV and *Aeromonas salmonicida*, but at much lower levels than salmonids



**Characterization of susceptibility and carrier status of burbot, *Lota lota* (L.), to IHNV, IPNV, *Flavobacterium psychrophilum*, *Aeromonas salmonicida* and *Renibacterium salmoninarum***

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Polinski et al., 2010. Journal of Fish Diseases.

# Second phase of program:

3. Semi-intensive/extensive rearing experiments
  - Semi-intensive “static” tanks – density studies
  - Extensive “natural” ponds used to determine feasibility (UI and IDFG)



Semi-intensive/extensive rearing tanks (above)



Juvenile burbot

# What's wrong in these pictures?



- Implemented grading and increased feeding rates

# Phase II: Experimental releases

4. In 2009, first release of hatchery reared burbot in BC, Canada and Idaho, US

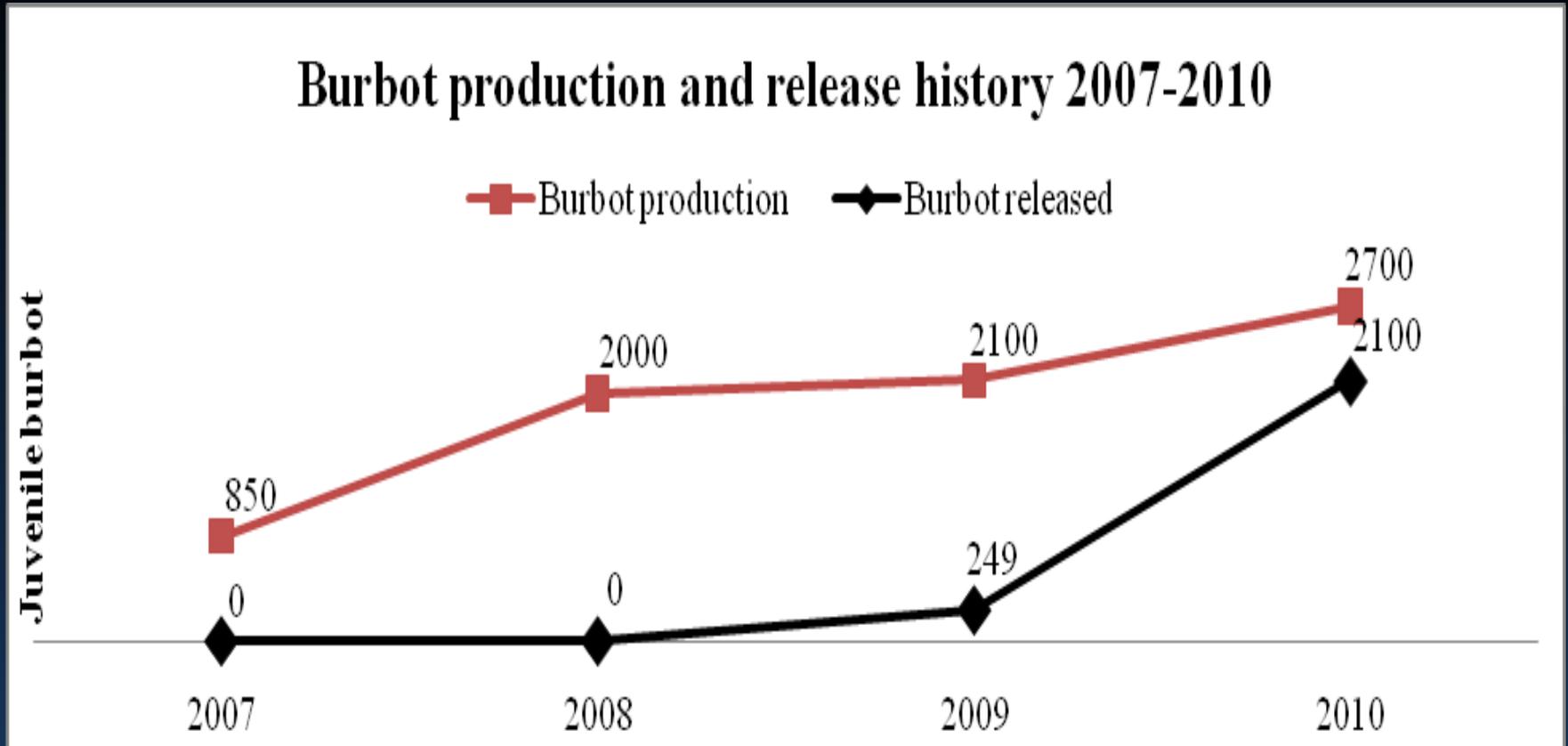


- Jensen and Cain. 2010. Hatchery International.
- Neufeld, et al. 2010. North American Journal of Fish Management.

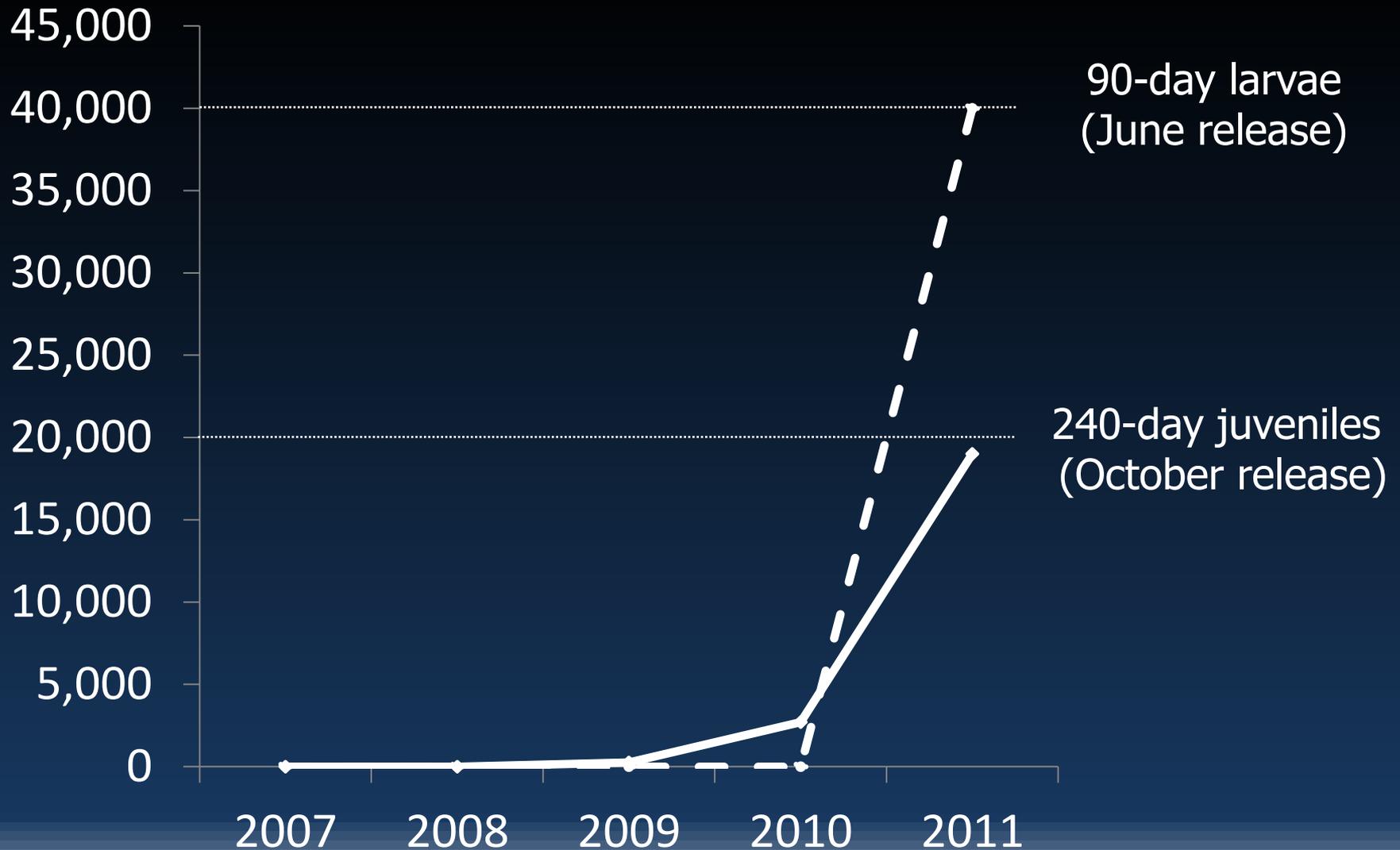
# Phase II: Experimental releases



# Burbot production and releases



# UI Experimental Hatchery Releases of Burbot



# Experimental releases

2009: 249 released in 4 different locations

- 30 of 249 implanted with ultrasonic transmitters

2010: 2100 fish released

- 55 of 2100 implanted with radio transmitters

2011: > 60,000 burbot released

- Larvae, juveniles, age 2 fish > 250 mm



# Third phase and future direction of program:

## Ongoing/completed research:

- Temperature related growth trials (completed)
- Continue optimizing all culture methods
- Monitor and evaluate release success and habitat selection (BC MoE, IDFG, UI, etc.)
- Tagging experiments (underway)

## Future direction:

- Continue releases and monitoring efforts
- Continue research to improve culture methods
- **Transfer technology to support new tribal hatchery facility**

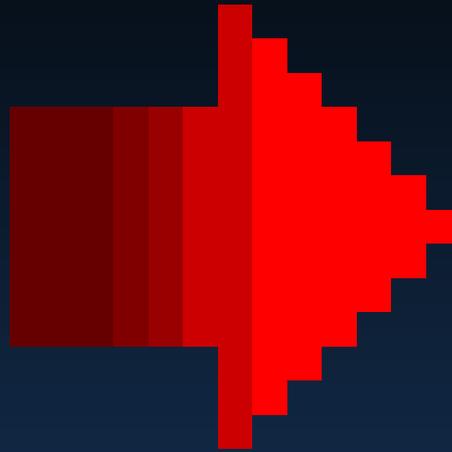
# Gamete collection 2010



# Gamete collection 2011



# Gamete collection 2010





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