



# McCloud River Redband trout reared at Mt. Shasta Hatchery



Mount Shasta Hatchery 2014



Photo courtesy of M. Dege

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# McCloud River Redband trout reared at Mt. Shasta Hatchery

- About MSH
- Why were the redbands brought to MSH?
- Why the hatchery used Recirculating Aquaculture System (RAS)
- What has taken place since the redbands arrival?
- What are the future plans of these fish?



# Mt. Shasta Hatchery

- Mt. Shasta Hatchery is located along the I5 corridor in Northern California
- Approximately 1 hour south of the Oregon Border
- Oldest operating hatchery west of the Mississippi River
- Started operation in 1888
- Spring Fed by Big Springs Creek (Headwaters of the Sacramento River) with an average water temperature in the lows 40's
- Major Broodstock Facility (Approximately 30 million triploid eggs/year)







# 13/14 Driest Water Year on Record in CA

Winters of 11/12, 12/13, 13/14, 14/15- all warm and dry

Effects on hatchery salmonids and wild fish survival

- Fish rescues of McCloud River Redband trout from
  - Edson Creek
  - Swamp Creek
  - Moosehead Creek

U.S. Drought Monitor  
California



Photo's courtesy of Dr. M. Clifford, M. Dege, S. Plemons



## McCloud River Redband rainbow trout, *Oncorhynchus mykiss stonei*

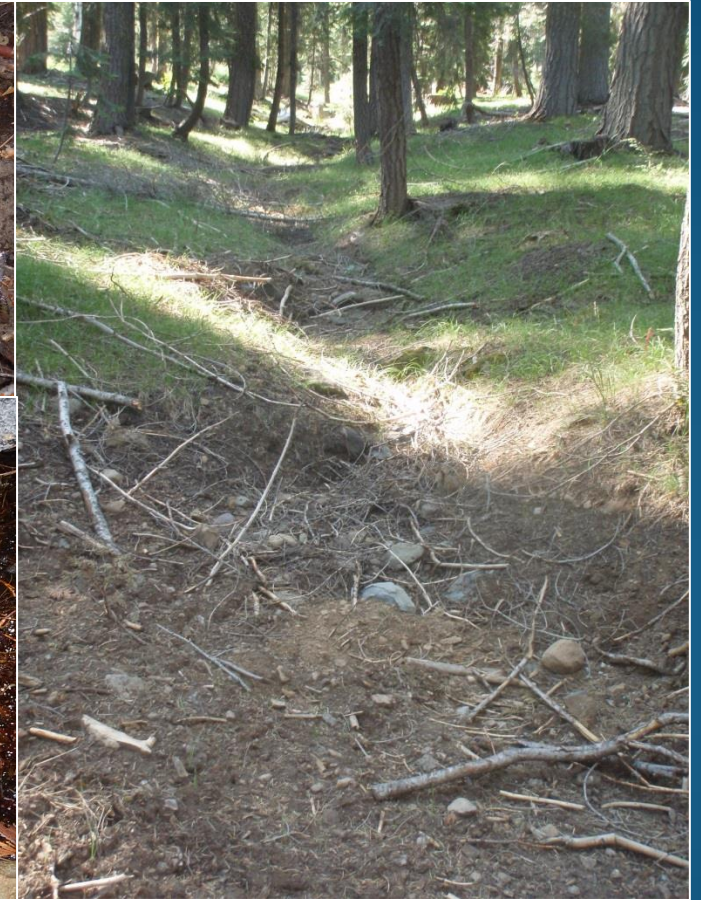


- 1 of 11 Heritage Trout Species of California
- Species of Special Concern
- Found in the Upper McCloud River Basin (Shasta and Siskiyou County)





After months of weekly monitoring and instream movements water conditions become so adverse a decision had to be made.





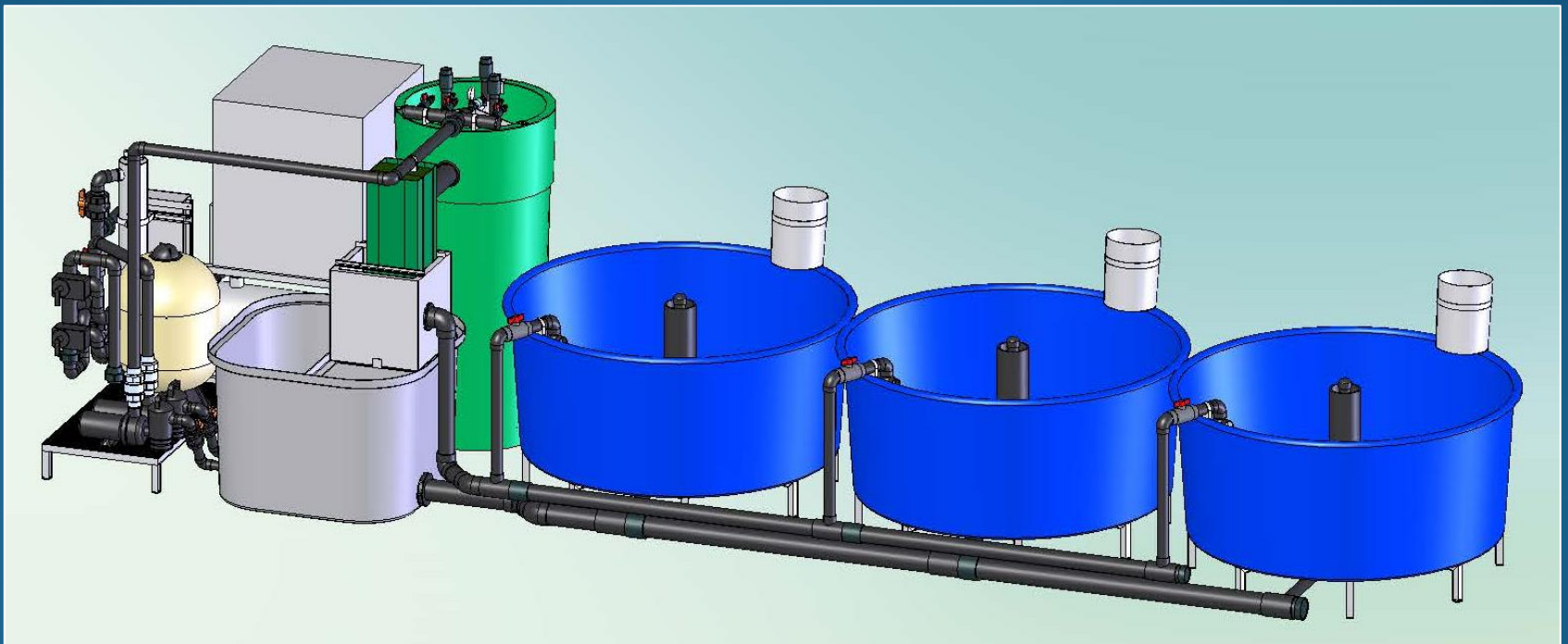
# The Rescue

- A decision was made to relocate the redbands to MSH
- Risks of moving fish from the wild to hatchery
  - AIS
  - Pathogens
- Bio security measure
  - Recirculating Aquaculture Systems (RAS)
- Do we have time to install the RAS and prepare them for fish?
  - Infrastructure
  - Electrical
  - Establishing the RAS bio filters





# Self-contained (Drought Safe Haven) Recirculating Aquaculture Systems (RAS)







- In late June (2014) the first RAS arrived at MSH and construction begin
  - 6 hatchery troughs and 1 deep tank were removed
  - Additional electrical had to be installed to accommodate pumps, UV, and chiller
  - Construction took approximately 2 days to complete





- On Day 2 water was added to the system
- Feeding of the Bio-Filters started
  - 2 weeks to establish





- By Mid July (2014) the RAS was ready for fish but not without setbacks
  - Pipes became clogged with fish feed
  - Filters clogged from over feeding systems
  - Tanks over flowing
  - Drains not properly draining
- But with a lot of trial and error the RAS were ready for fish







# The Rescue's

- 8/28/14, 128 Redband trout rescued from Edson Creek
- 8/29/14, 98 Redband trout rescued from Edson Creek
- 9/2/14, 517 Redband trout rescued from Swamp Creek
- 9/17/14, 269 Redband trout rescued from Moosehead Creek
- A total of 1,012 McCloud River Redband trout were rescued and moved to MSH
  - In route predation was observed
  - Cages were constructed to segregate fish by size





# Added Precaution

- Pathology approved fish before transfer but also recommended
- As part of the quarantine process:
  - 6 hour bath of Oxytetracycline @ 100 ppm
    - Treatment was conducted in 400 gallon tank on fish planting truck
  - Once the fish had been treated and placed in the RAS they were given a 3 day bath of formalin at 140 ppm for 1 hour
    - Formalin does not kill nitrifying bacteria



# How do we Rear Wild Trout?

- Concerns of rearing wild trout
  - Very high profile fish
    - A lot of pressure to succeed
  - Large variation in size
  - Feeding wild fish
    - Insects to commercial diets







# Additional Systems

- In late January 2015, 2 additional RAS were brought to MSH
  - Able to segregate fish by stream and by size
- Installation much smoother
  - Bio-filter established utilizing water from existing system
  - 2 days the systems were ready for fish
- Fish from each creek were re-inventoried into the new systems
  - All cages were removed from the systems





# Rearing McCloud River Redband trout

- Everything went smooth for the next two months
  - Slight modifications to the systems
  - Feeding/Cleaning/General Fish Care
- Monthly meeting discussing fish disposition
  - To Spawn or Not to Spawn?
    - At this time we decided to do a conservation program
    - Genetic work was already done
      - UCD
      - Genetics suggested outcrossing tributaries







# Spawning

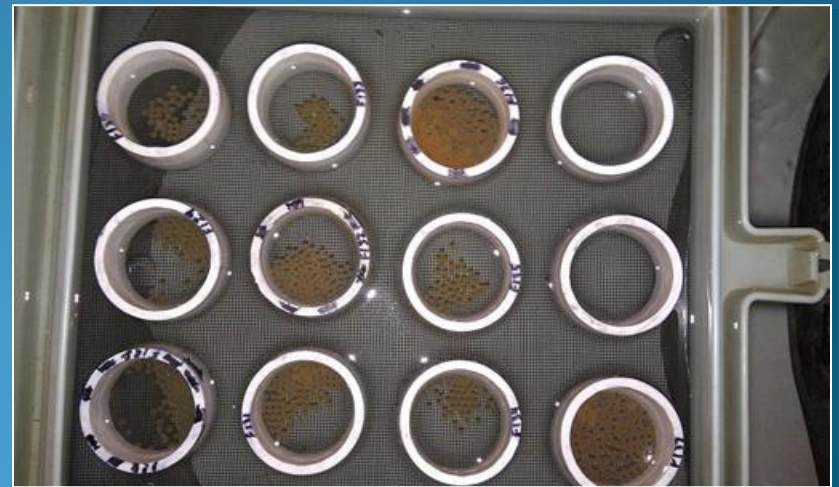
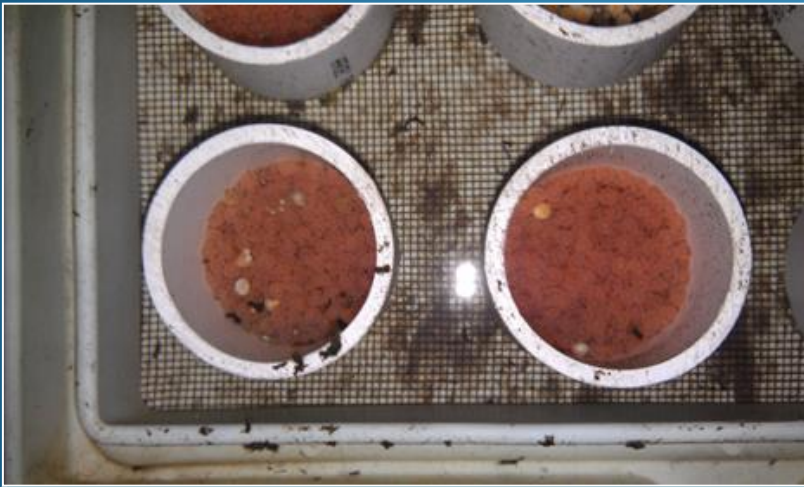
- Adult genetic collections on all spawned fish
- Mark all spawned fish (physical and PIT)
- True 1:1 pairings (one male with one female)
- Individual families held separately





# Spawning

- 42 family groups
- Approximately 5,500 eggs were taken





# Spawning

- By July 2015 approximately 4500 good eggs were set out to hatch







- These videos are of the first family group starting to hatch
- This took place approx. 52 days post fertilization
- Eggs were set out in egg baskets to hatch
- Inflowing water was set around 5 gpm
- Baskets were lifted and troughs were cleaned daily
- As the eggs hatched the sac fry would fall through the bottom of the baskets coming to rest in the troughs
- Approximately 30 days after the fish would hatch they would begin to look for food





# Egg Updates

- In October 2015 visual counts
  - Conservative estimates (1,500)
  - Initial goal was 1000 fish
  - More genetically diverse
  - Readily eating commercial diets
  - All family groups kept separate





# Conservation Program

1. Complex substrate/rearing environment
2. Water temperature (2013-15 McCloud stream data)
3. Photoperiod (2015 McCloud area natural photo period)

Trying to mimic natural environment

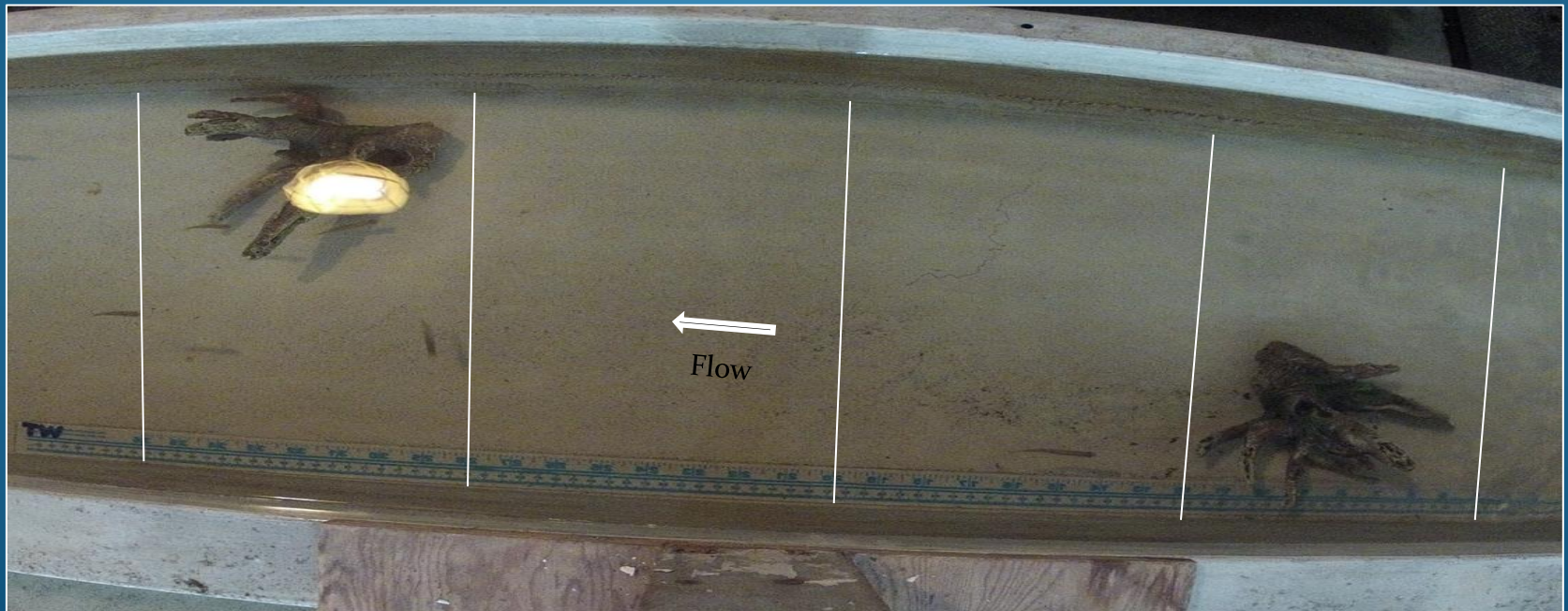


Photo's courtesy of M. Dege





# Complex Rearing Habitat







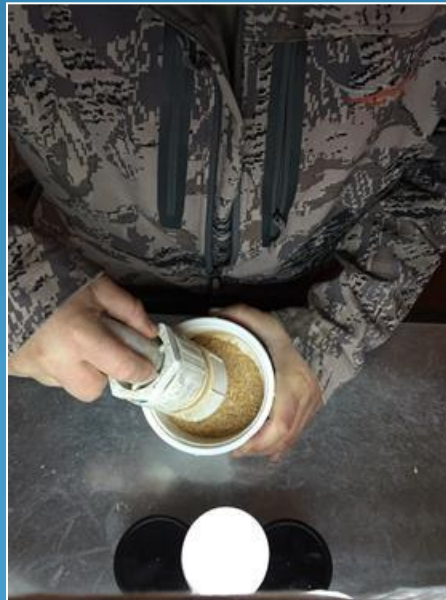
## Artificial/Natural Habitat



Photo's courtesy of M. Dege



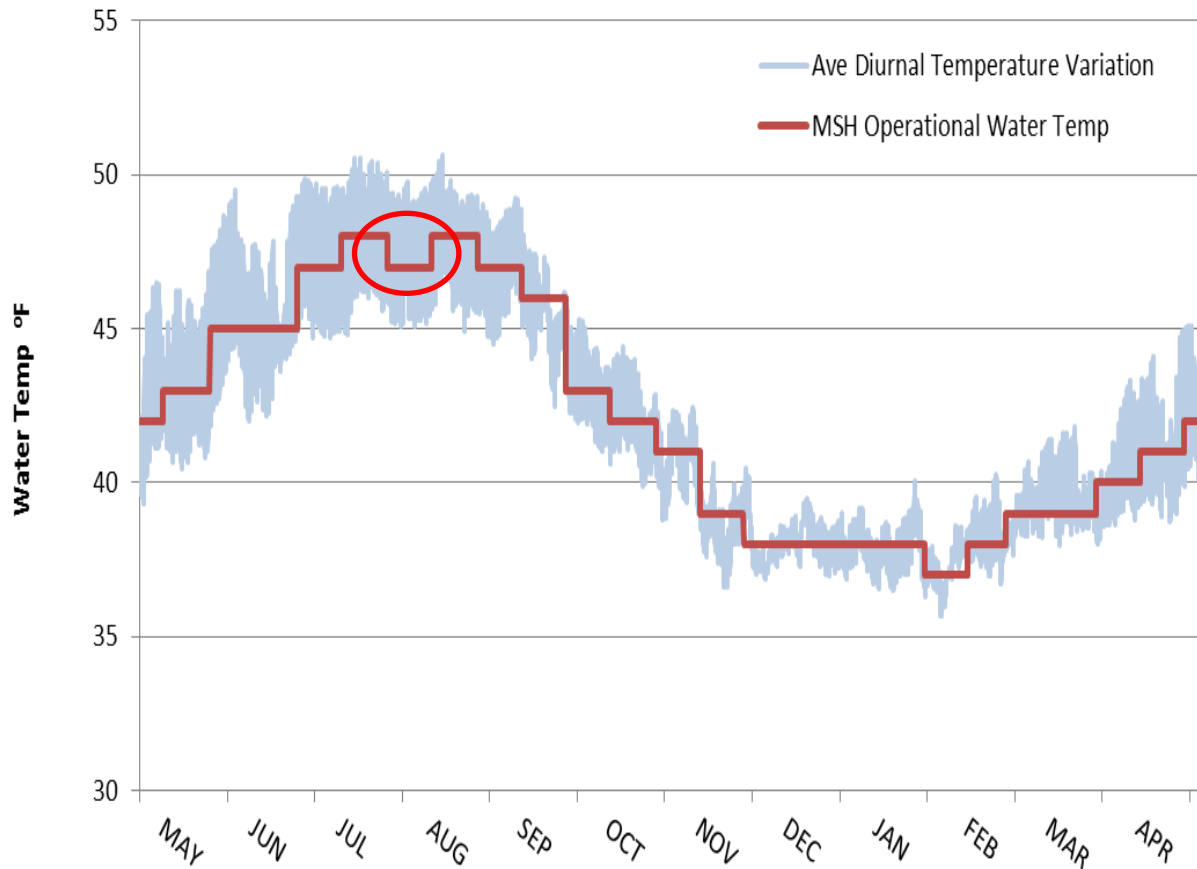
# Feeding







# Water Temperatures



Water Temperature

Jan (1-15)	38
Jan (16-31)	38
Feb (1-15)	37
Feb (16-28)	38
Mar (1-15)	39
Mar (16-31)	39
Apr (1-15)	40
Apr (16-30)	41
May (1-15)	42
May (16-31)	43
Jun (1-15)	45
Jun (16-30)	45
Jul (1-15)	47
Jul (16-31)	48
Aug (1-15)	47
Aug (16-31)	48
Sep (1-15)	47
Sep (16-30)	46
Oct (1-15)	43
Oct (16-31)	42
Nov (1-15)	41
Nov (16-30)	39
Dec (1-15)	38
Dec (16-31)	38



# Moving Forward

- Conservation program will continue
- Maintain broodstock
- Release fish back into the wild
- Produce heritage fish for recreational angling?





# Questions?

