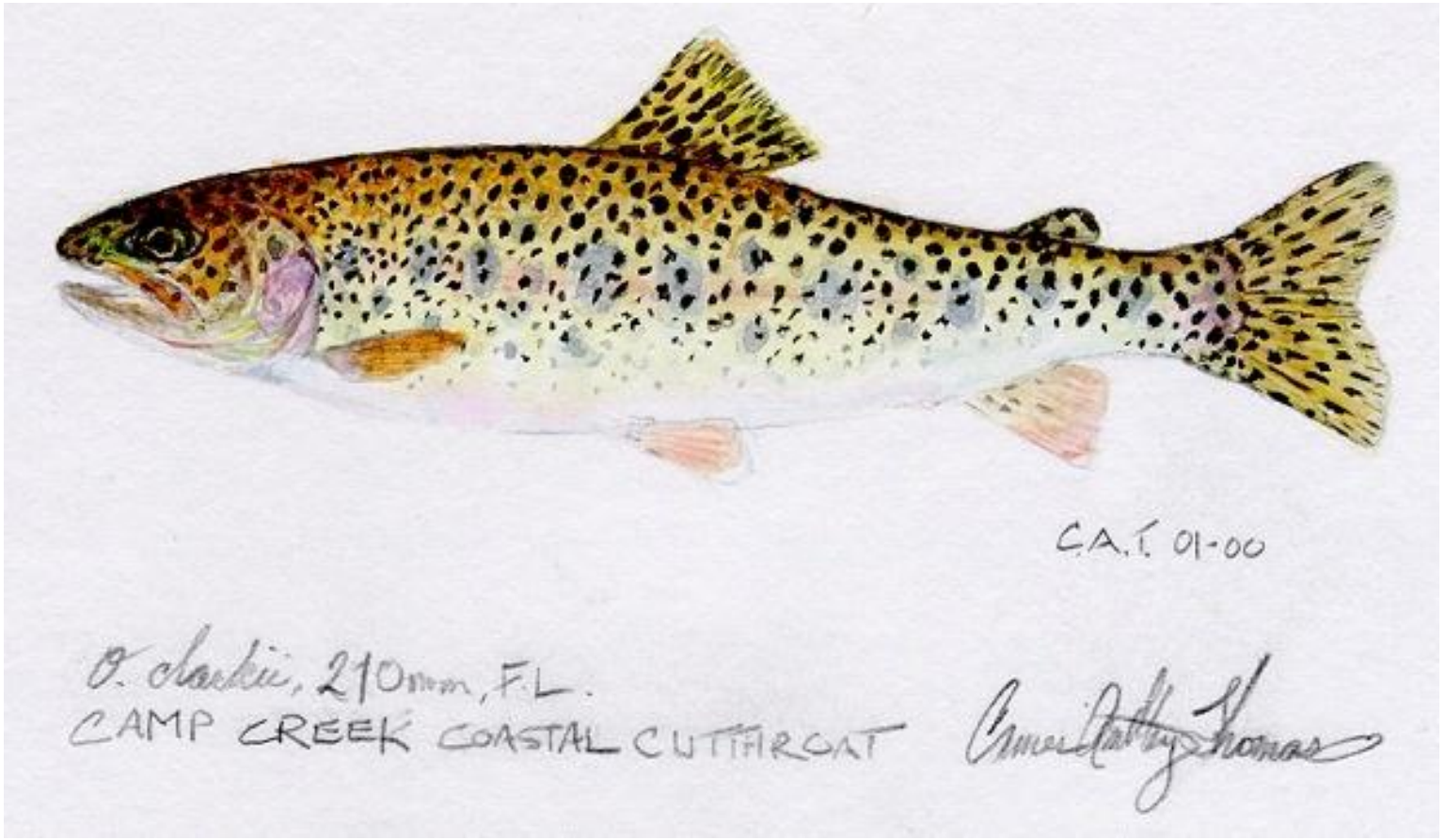
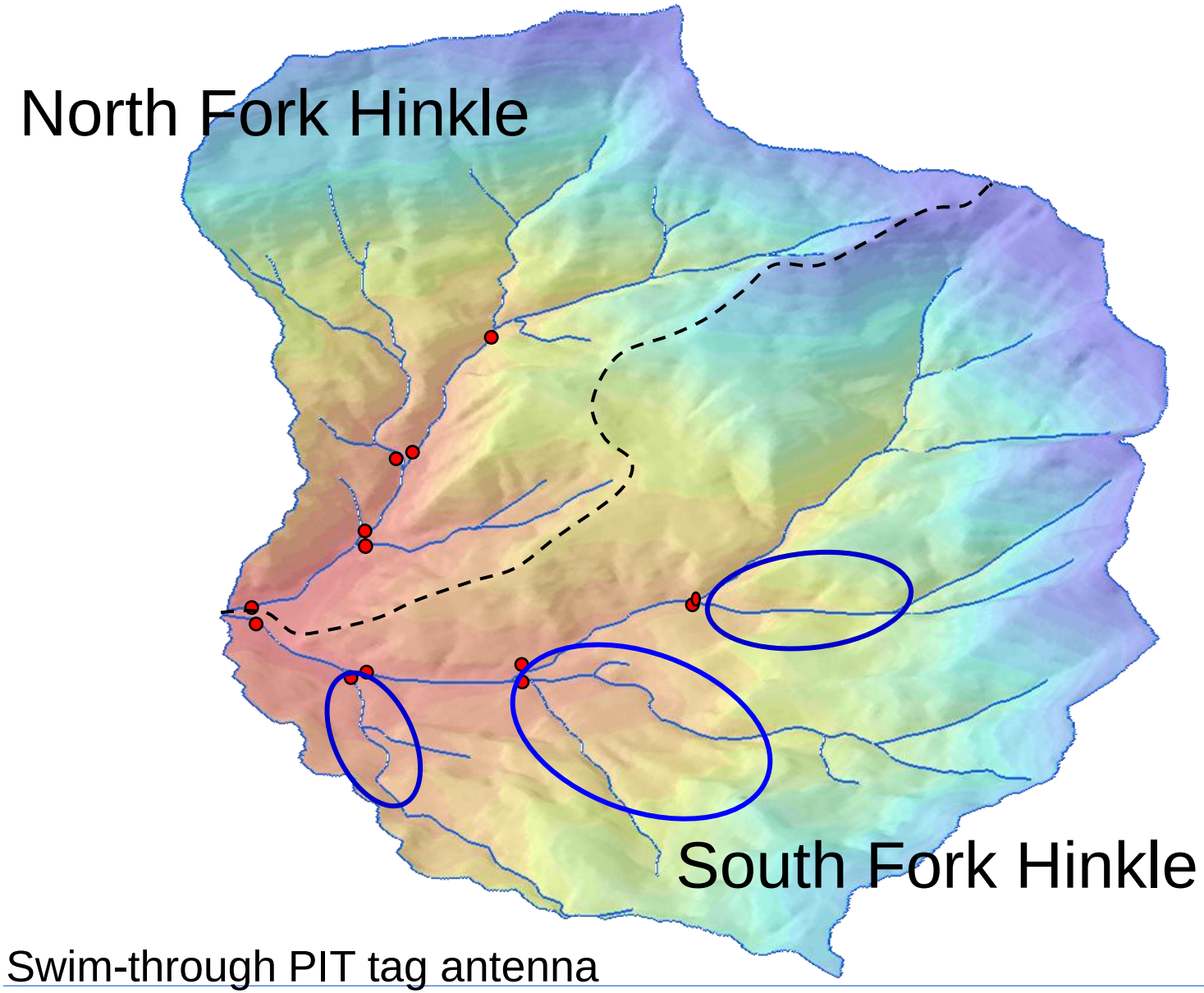
# How Have the Fish Responded to Riparian Management? What are the Implications for Future Management?




# Range of Riparian Condition

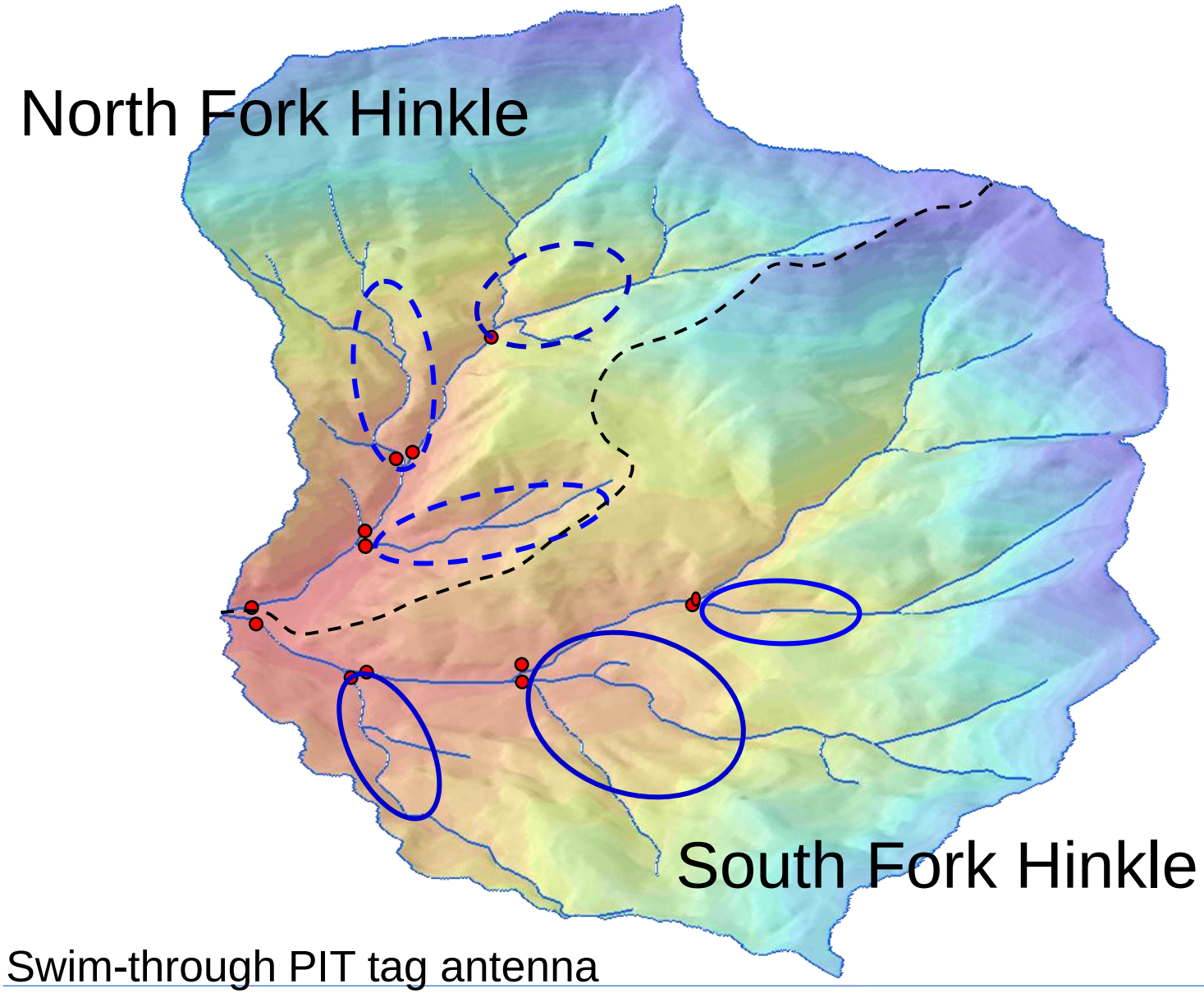
# Spatial Scales

# Tributary Scale



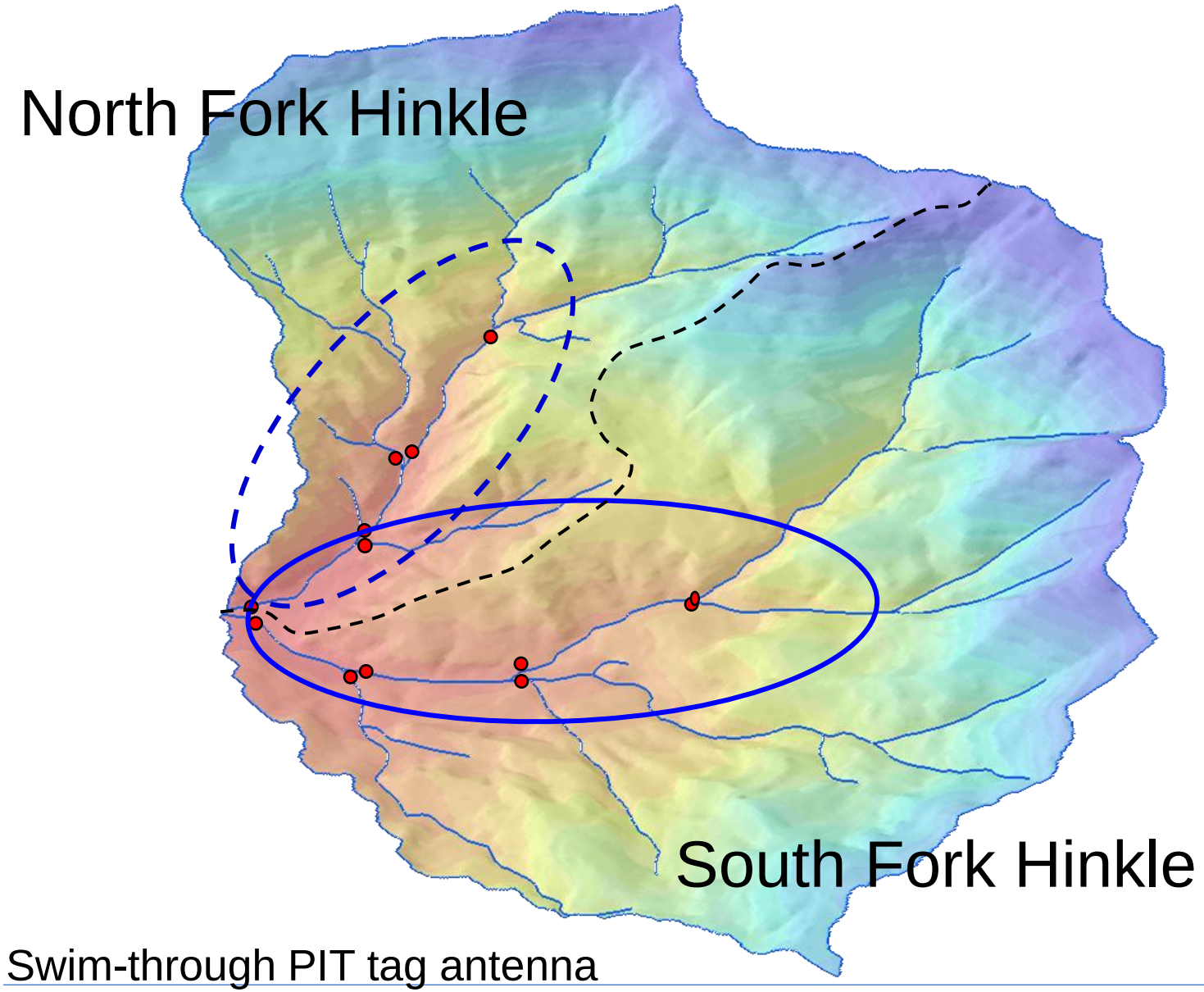

- Swim-through PIT tag antenna

# Tributary Scale



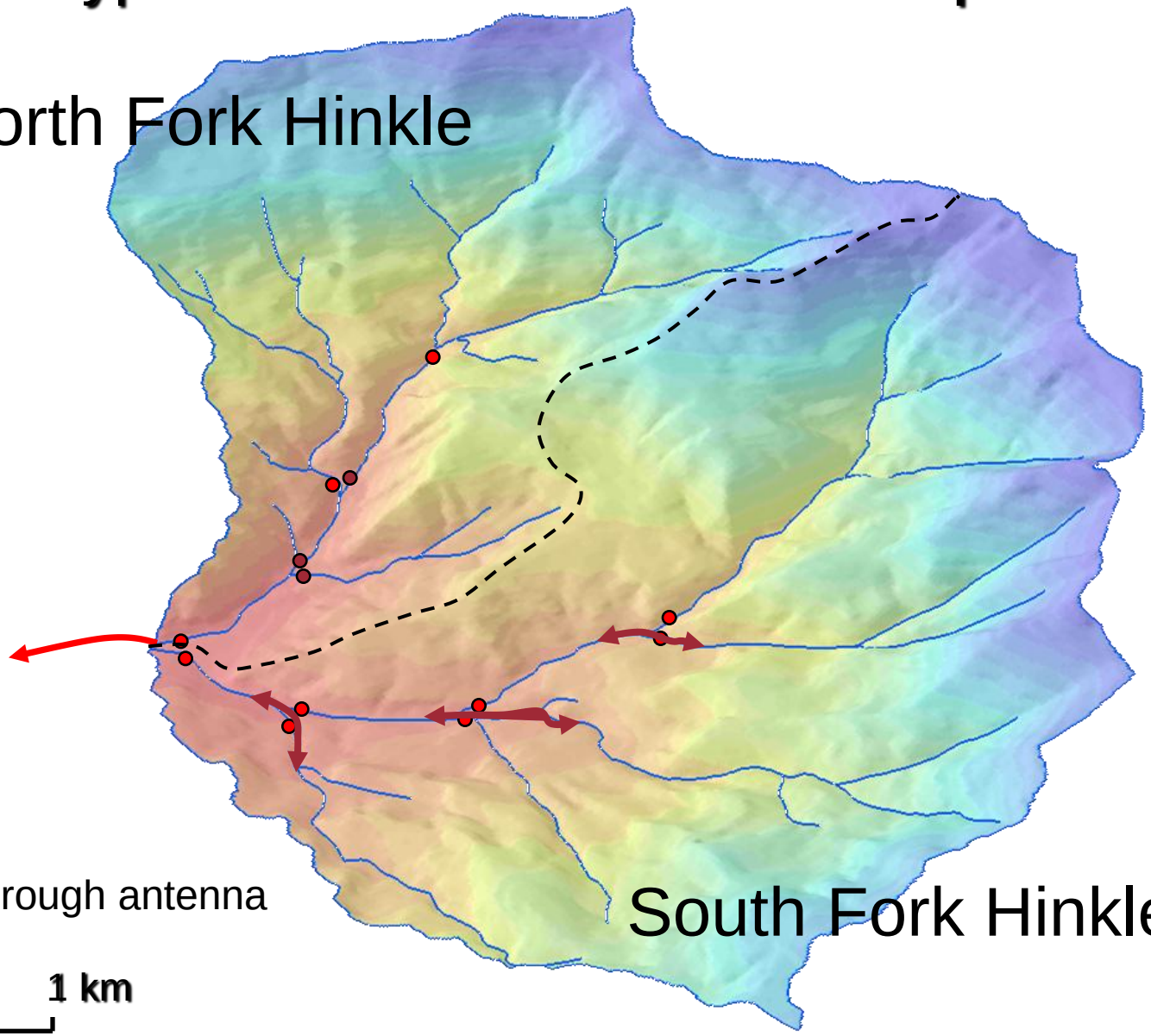

- Swim-through PIT tag antenna

# Catchment Scale




- Swim-through PIT tag antenna

# Hypotheses On Behavioral Response

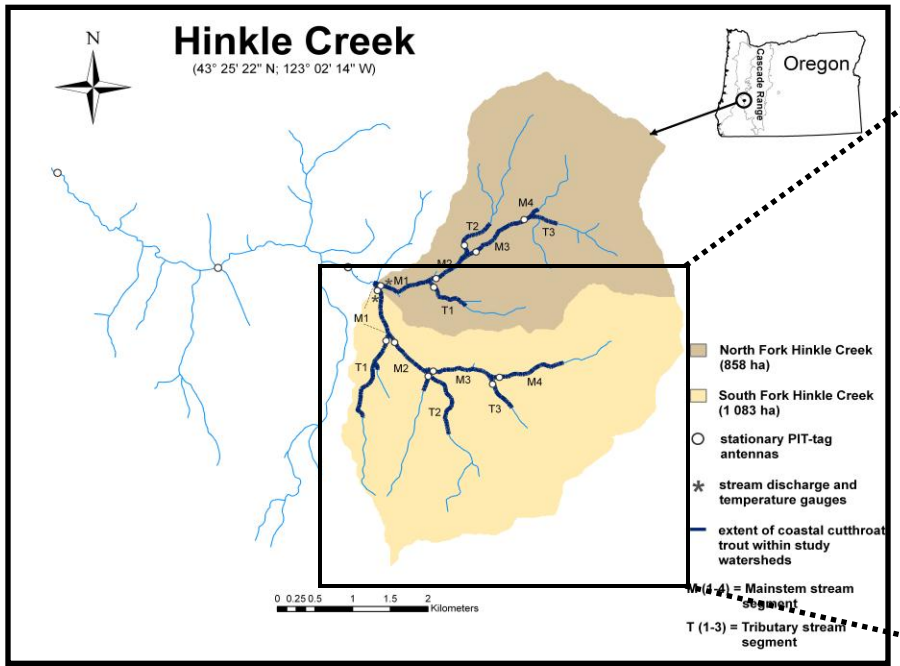


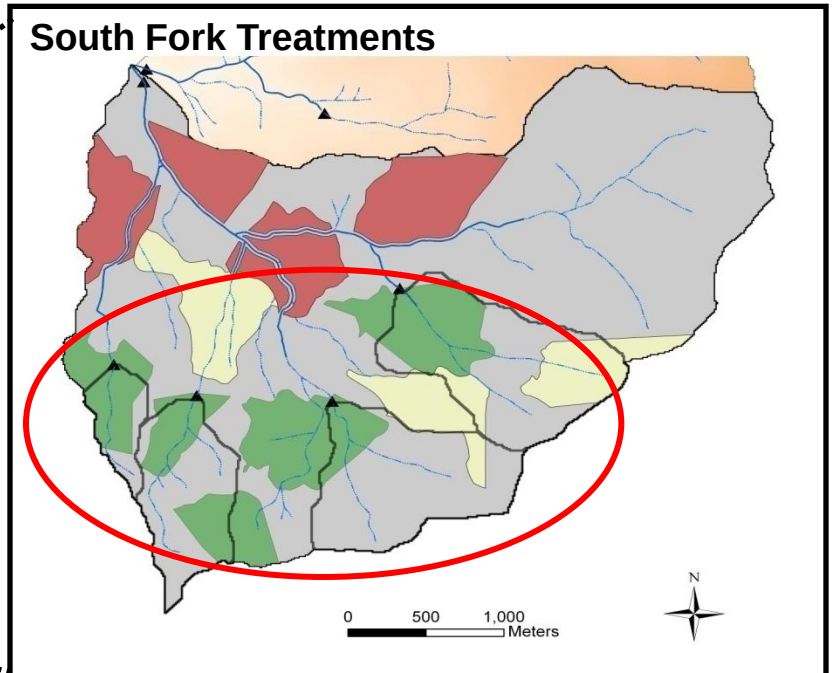
# Hinkle Creek First Entry

# Experimental Timeline: Hinkle Creek

**Calibration Phase** → **Treatment Phase**

| 2001 | 2006 | 2009 | 2011 |
|---|---|---|---|
| Study Begins | Treatment 1: (Non-Fish Bearing) | Treatment 2: (Fish Bearing) | Study Ends |

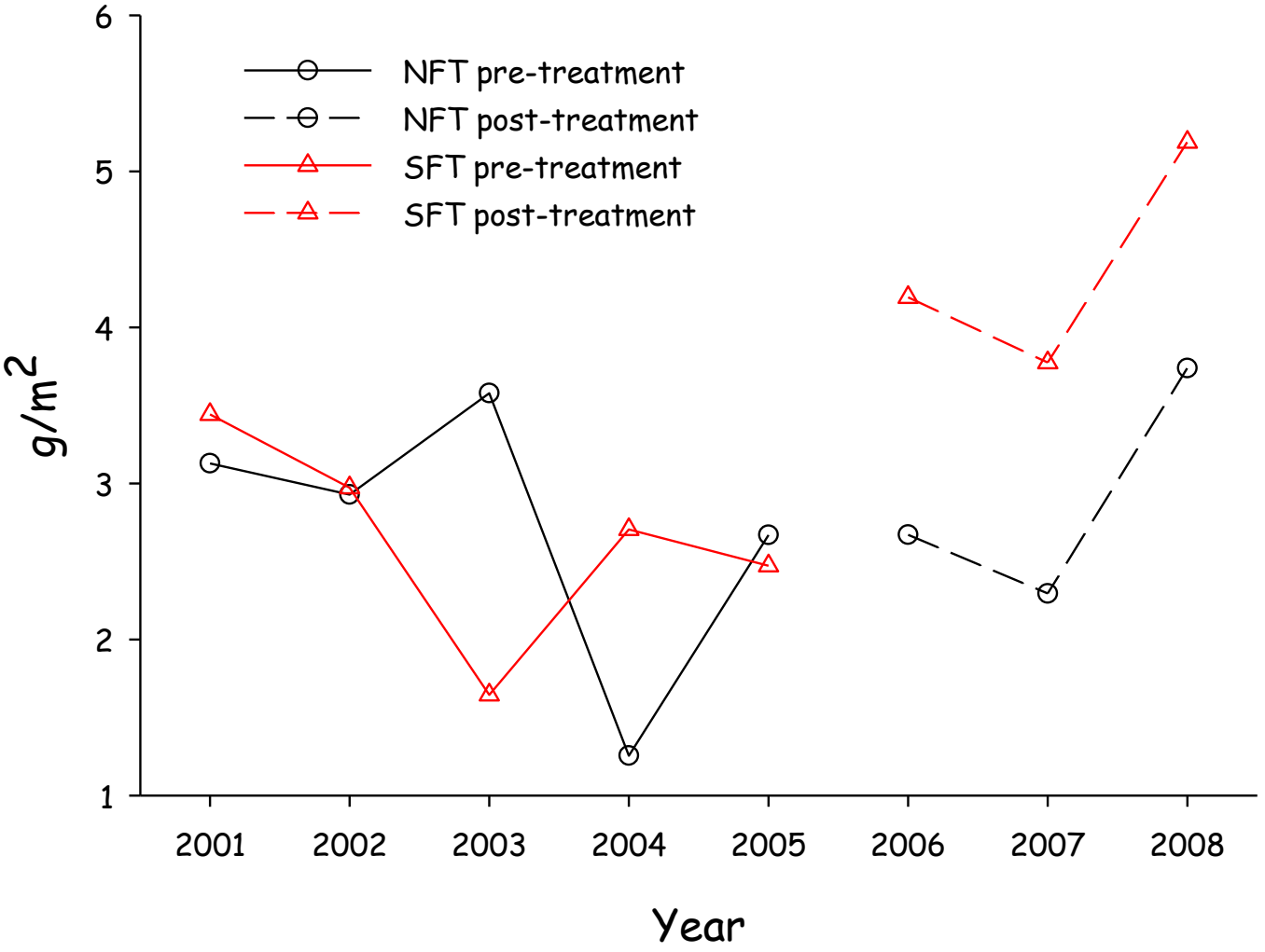


Currently streams without fish or a domestic water use do not require the retention of a standing tree buffer.

# Results

# Mean Biomass of Age 1+ Cutthroat Trout in Pool Habitats North and South Fork Hinkle Creek: Tributary Scale



# Summary First Harvest Tributary Scale

| Response | Age 1+ Cutthroat | Age 0 Trout |
|---|---|---|
| Biomass | ↑ | NC |
| Abundance | ↑ | NC |
| Size | NC | NC |
| Condition | NC | NC |
| Survival | NC | NA |
| Behavior | NC | NA |

↑ = detectable treatment effect with relative increase in treated catchment

↓ = detectable treatment effect with relative decline in treated catchment

NC = no detectable treatment effect

NA = not measured for this age class or species

IP = in process

# Summary First Harvest Catchment Scale

| Response | Age 1+ Cutthroat | Age 0 Trout |
|---|---|---|
| Biomass | NC | NC |
| Abundance | NC | NC |
| Size | NC | NC |
| Growth | NC | NA |
| Condition | NC | NC |
| Survival | NC | NA |
| Behavior | NC | NA |

↑ = detectable treatment effect with relative increase in treated catchment

↓ = detectable treatment effect with relative decline in treated catchment

NC = no detectable treatment effect

NA = not measured for this age class or species

IP = in process

# Experimental Timeline: Hinkle Creek

## Calibration Phase

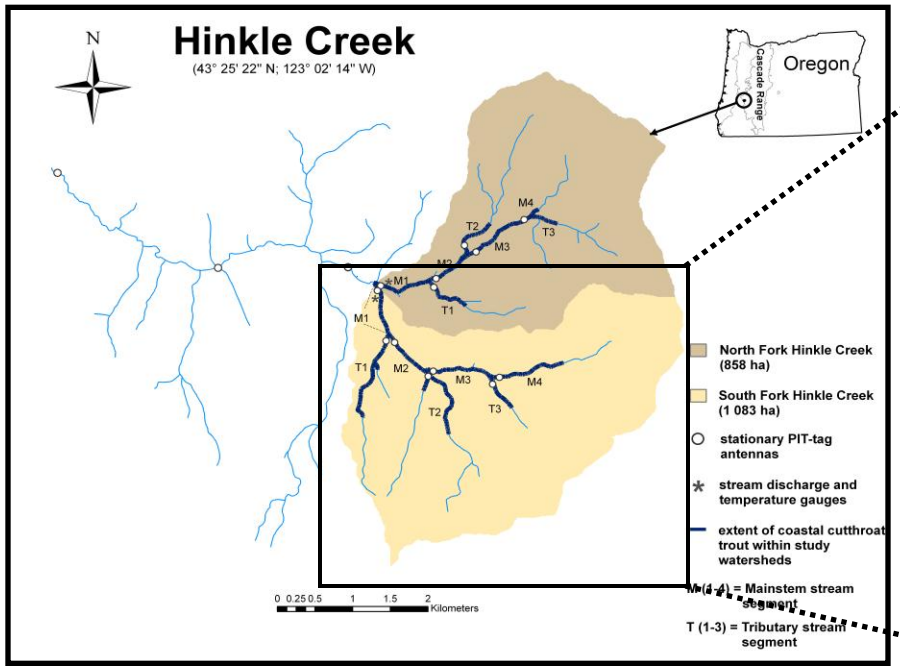
## Treatment Phase

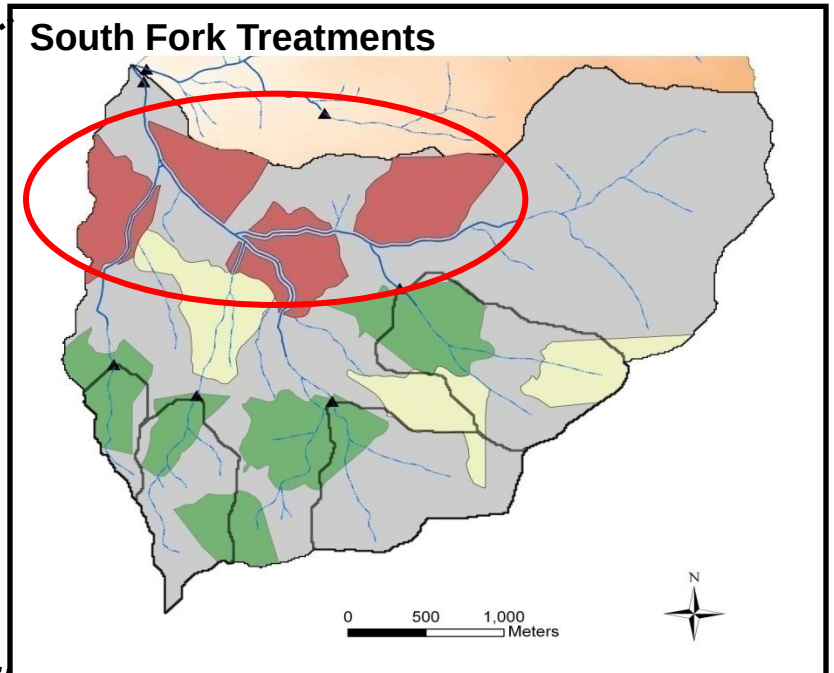
**2001** — **Study Begins**

**2006** — **Treatment 1: (Non-Fish Bearing)**

**2009** — **Treatment 2: Log 4 MU (Fish Bearing)**

**2011** — **Study Ends**



# Summary Second Harvest Tributary Scale

| Response | Age 1+ Cutthroat | Age 0 Trout |
|---|---|---|
| Biomass | ↑ | ↑ |
| Abundance | NC | ↑ |
| Size | ↑ | ↑ |
| Condition | NC | NC |
| Survival | NC | NA |
| Behavior | NC | NA |

↑ = detectable treatment effect with relative increase in treated catchment

↓ = detectable treatment effect with relative decline in treated catchment

NC = no detectable treatment effect

NA = not measured for this age class or species

IP = in process

# Summary Second Harvest Catchment Scale

| Response | Age 1+ Cutthroat | Age 0 Trout |
|---|---|---|
| Biomass | NC | ↑ |
| Abundance | NC | ↑ |
| Size | ↑ | ↑ |
| Growth | ↑ | NA |
| Condition | NC | NC |
| Survival | IP | NA |
| Behavior | NC | NA |

↑ = detectable treatment effect with relative increase in treated catchment

↓ = detectable treatment effect with relative decline in treated catchment

NC = no detectable treatment effect

NA = not measured for this age class or species

IP = in process

# Habitat Summary Second Harvest

| Response | Tributary | Catchment |
|---|---|---|
| Pool Area | NC | NC |
| Pool Length | NC | NC |
| Pool Depth | NC | NC |
| Fine Sediment | NC | NC |

↑ = detectable treatment effect with relative increase in treated catchment

↓ = detectable treatment effect with relative decline in treated catchment

NC = no detectable treatment effect

NA = not measured for this age class or species

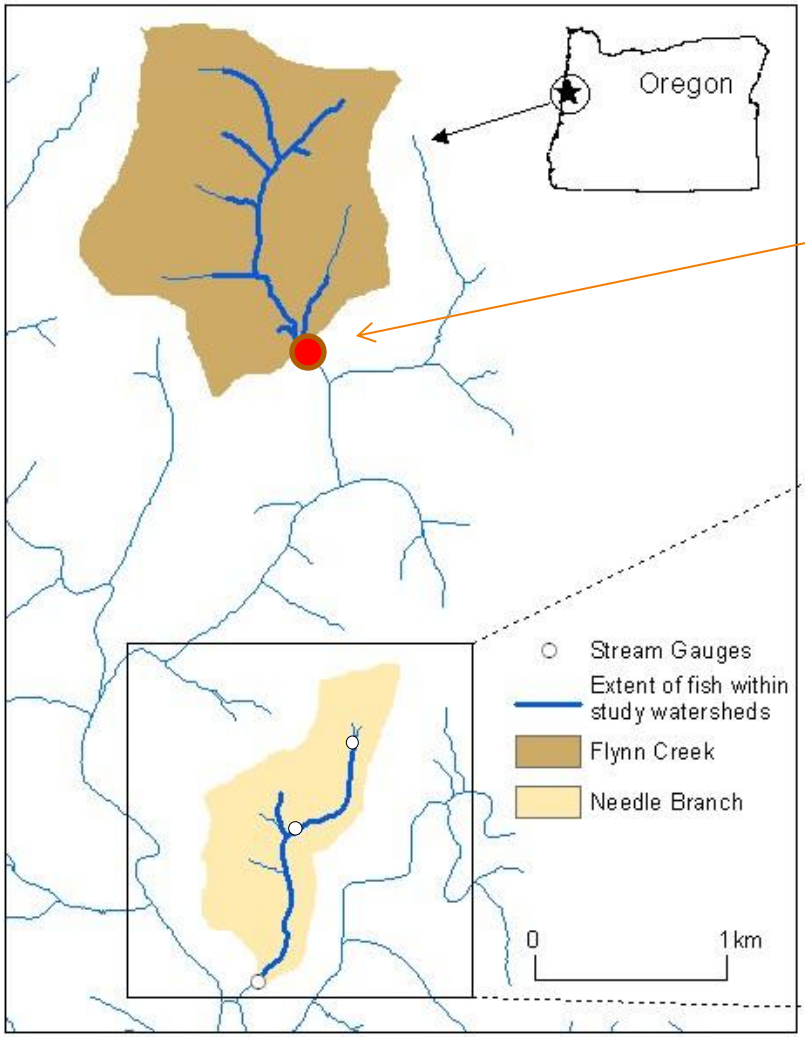
IP = in process

# Alsea First Harvest

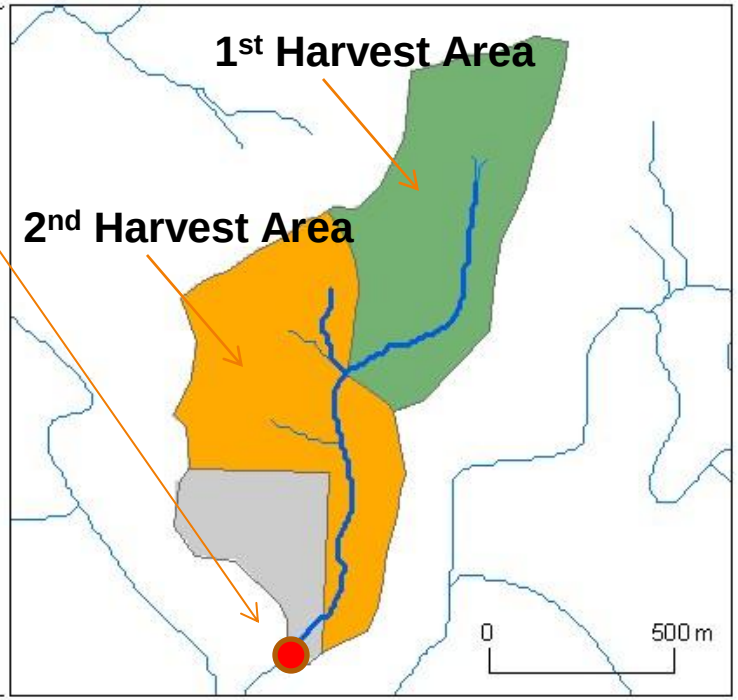
# Experimental Timeline: Alsea Watershed Study Revisted

**Calibration Phase** — **1st Harvest** — **2nd Harvest**

**2006** Study Begins — **2009** — **2014** — **2017** Study Ends



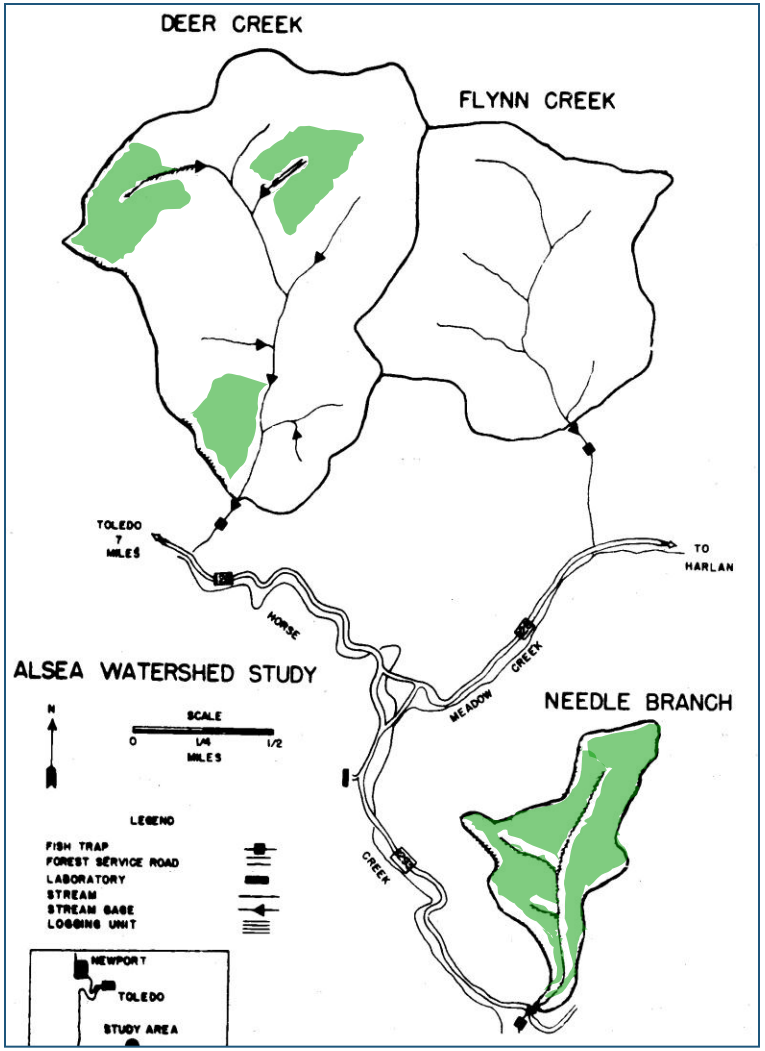

Swim Through PIT Tag Antennas



# Experimental Timeline: Alsea Watershed Study

**AWS Study Begins** — **Gregory et al** — **AWSR**

1959 — 1966 — 1976 — 1988 — 1996 — 2006 — 2009 — 2014 — 2017



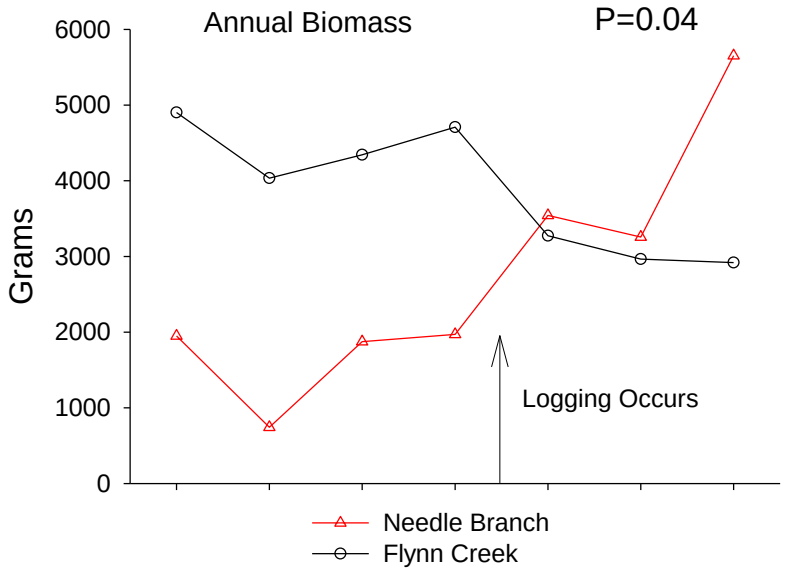

## AWS 1959-1976

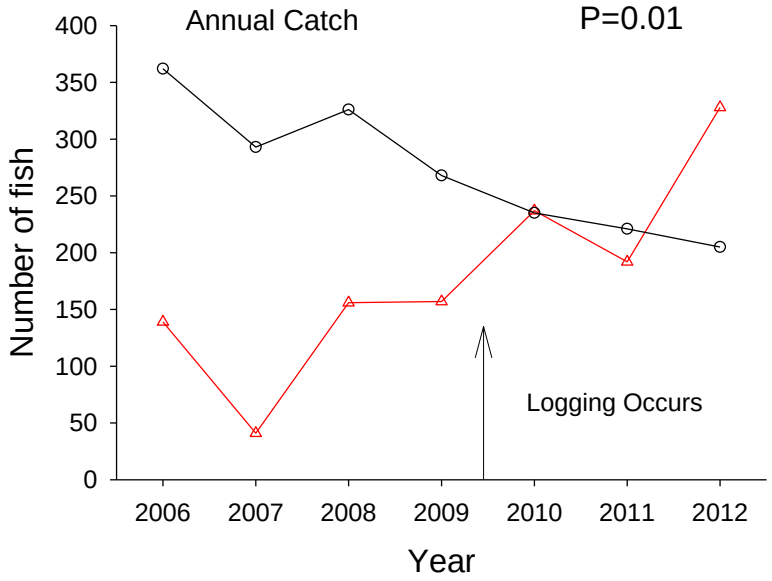
- Needle Branch: 82% Clear cut, not buffers stream cleaned, burned post-logging
- Deer Creek: 25% Clear cut in three patches 15-30m buffers along streams
- Flynn Creek: Burned in mid 1850's never Logged.

## Gregory et al 1988-1996

- Sampled all three streams
- Established 4-5 plots per stream equal to approximately 20% of the stream length sampled in the AWS

# Needle Branch and Flynn Creek: Annual Total Biomass and Catch of Age 1+ Cutthroat Trout



# Summary First Harvest

| Response | Age 1+ Cutthroat | Age 0 Trout | Coho |
|---|---|---|---|
| Biomass | ↑ | NC | NC |
| Abundance | ↑ | NC | NC |
| Size | NC | ↓ | NC |
| Growth | NC | NA | NA |
| Condition | NC | NC | NC |
| Survival | IP | NA | NA |
| Behavior | NC | NA | NA |

↑ = detectable treatment effect with relative increase in treated catchment

↓ = detectable treatment effect with relative decline in treated catchment

NC = no detectable treatment effect

NA = not measured for this age class or species

IP = in process

# Habitat Summary Harvest

| **Response** | |
|---|---|
| Pool Area | ↑ |
| Pool Length | NC |
| Pool Depth | NC |
| Fine Sediment | NC |
| Cover (All) | NC |

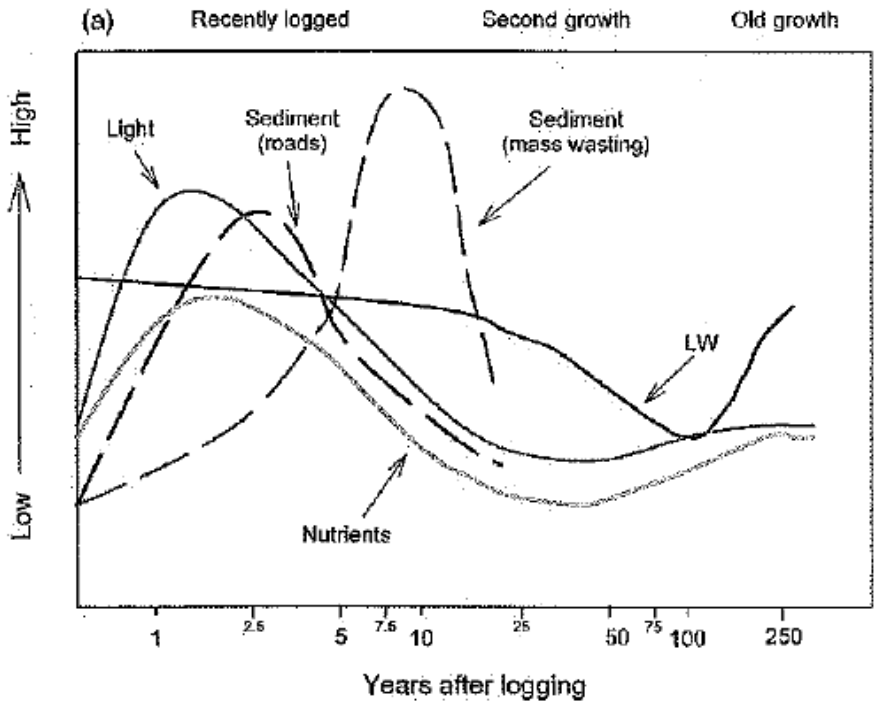
↑ = detectable treatment effect with relative increase in treated catchment

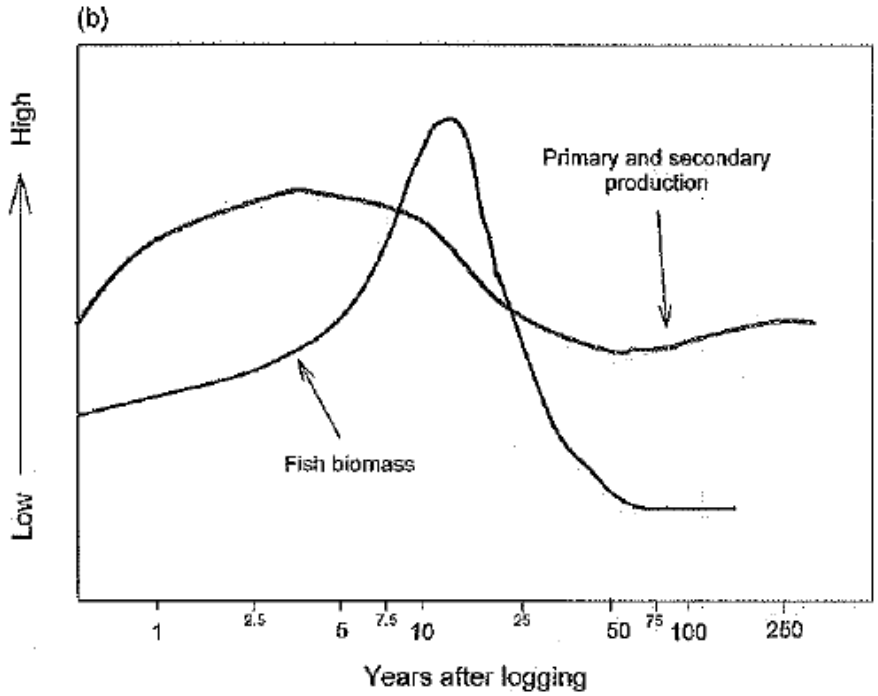
↓ = detectable treatment effect with relative decline in treated catchment

NC = no detectable treatment effect

NA = not measured for this age class or species

IP = in process

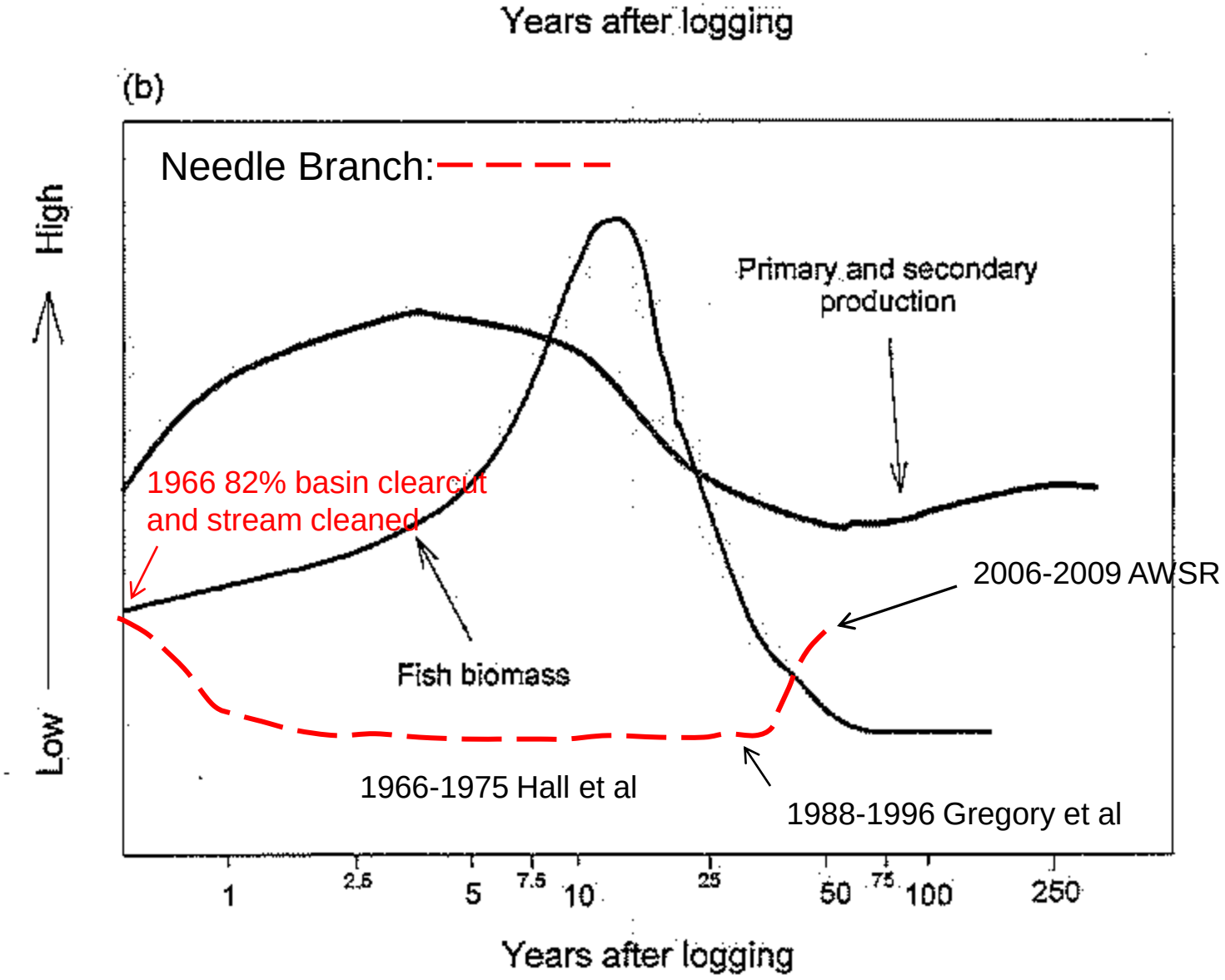


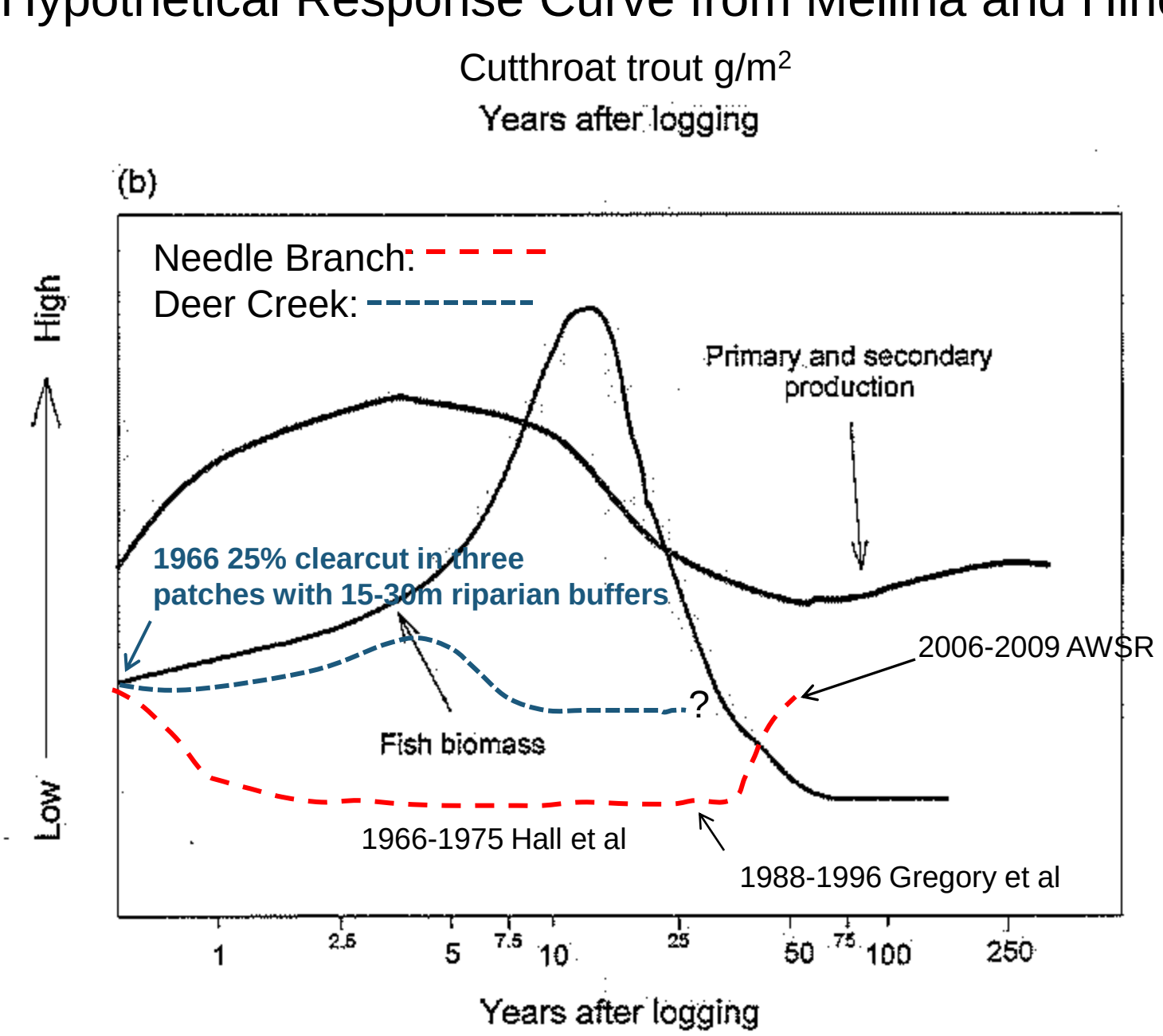

# Hypothetical Response Curves from Mellina and Hinch (2009)

# Hypothetical Response Curve from Mellina and Hinch (2009)

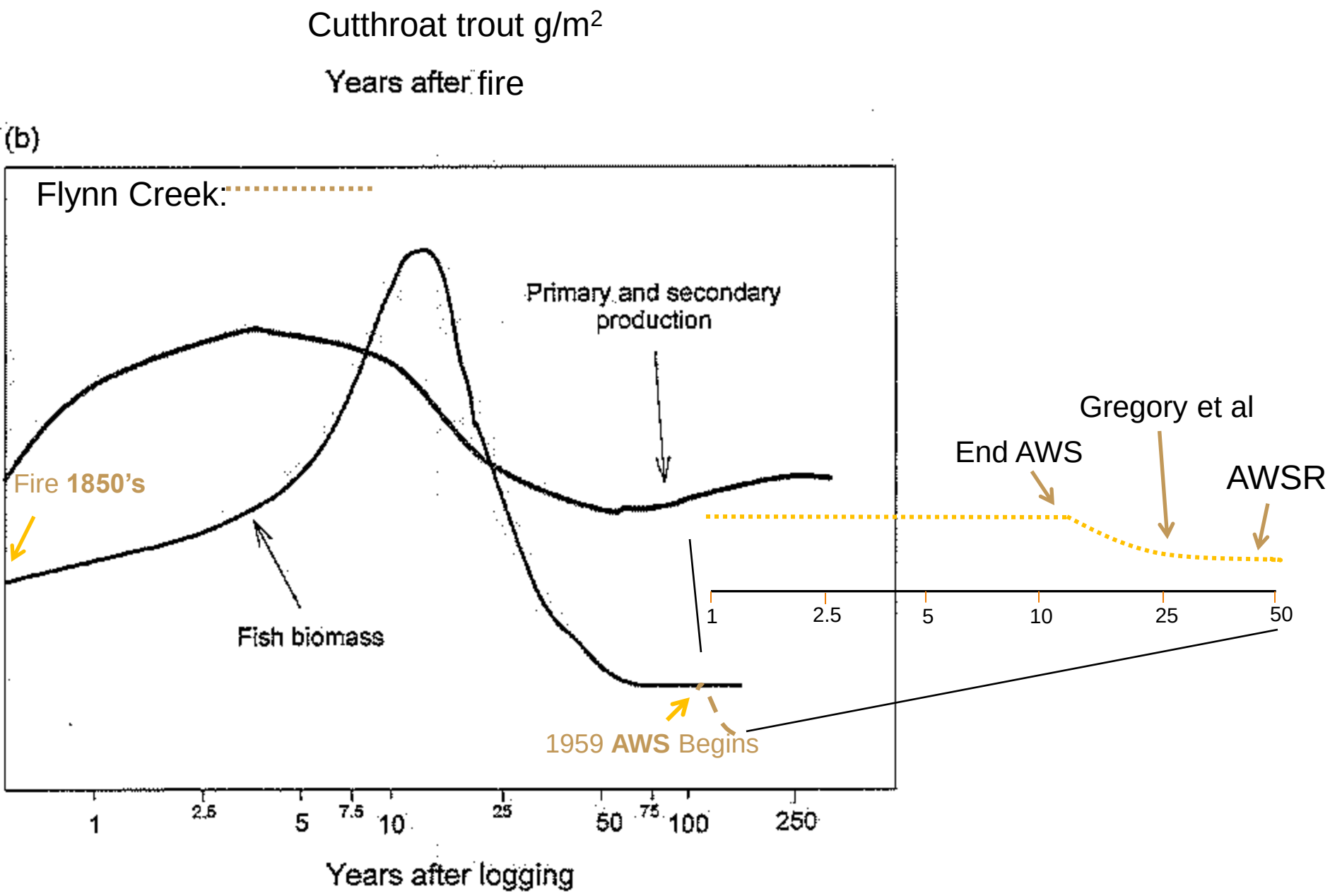
Cutthroat trout g/m$^2$



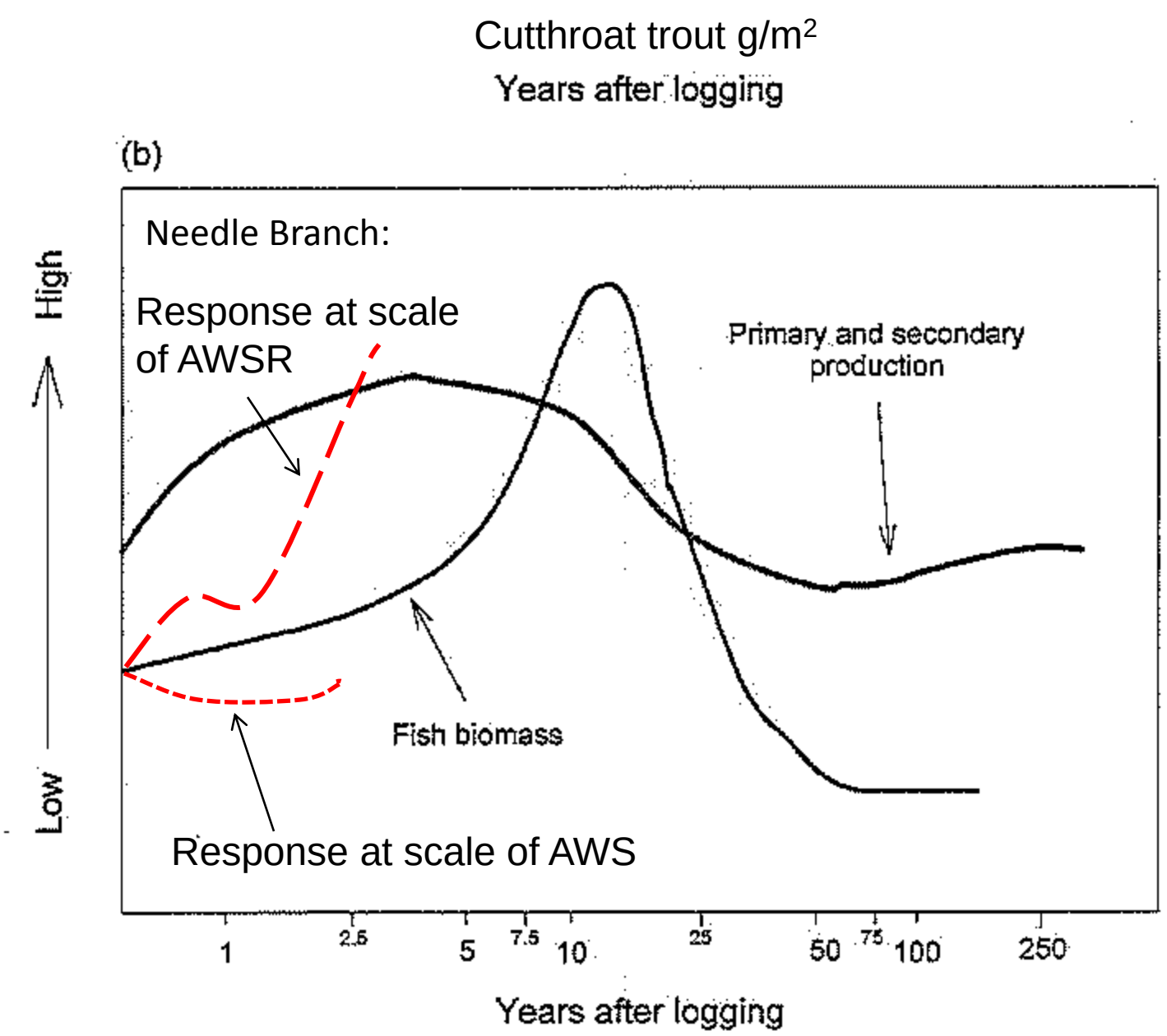
# Hypothetical Response Curve from Mellina and Hinch (2009)



# othetical Response Curve from Mellina and Hinch (2009)



# Hypothetical Response Curve from Mellina and Hinch (2009)



# What Do We Know!

Hinkle Creek

- Headwater harvest:
  increased abundance and biomass of age 1+ cutthroat trout in tributaries

- Downstream harvest:
  Biomass of all trout increased at catchment scale
  Size increased for age 0 trout and 1+cutthroat
  growth increased for age 1+ cutthroat

Alsea

- Increased biomass and abundance of age 1+ cutthroat trout
- Decline in length of age 0 cutthroat trout

# What Do We Know!

Overall

- Three years post-harvest: results for cutthroat trout are similar to those predicted from other studies

- The response of steelhead and coho differed from that of cutthroat trout

- Little evidence of acute negative effects on habitat

# What We Think!

- Observed increases in abundance/biomass will eventually peak and then decline

# What  Need to Learn!

- How fish response behaves through time, through a rotation and through multiple rotations

- How populations response to current management regimes