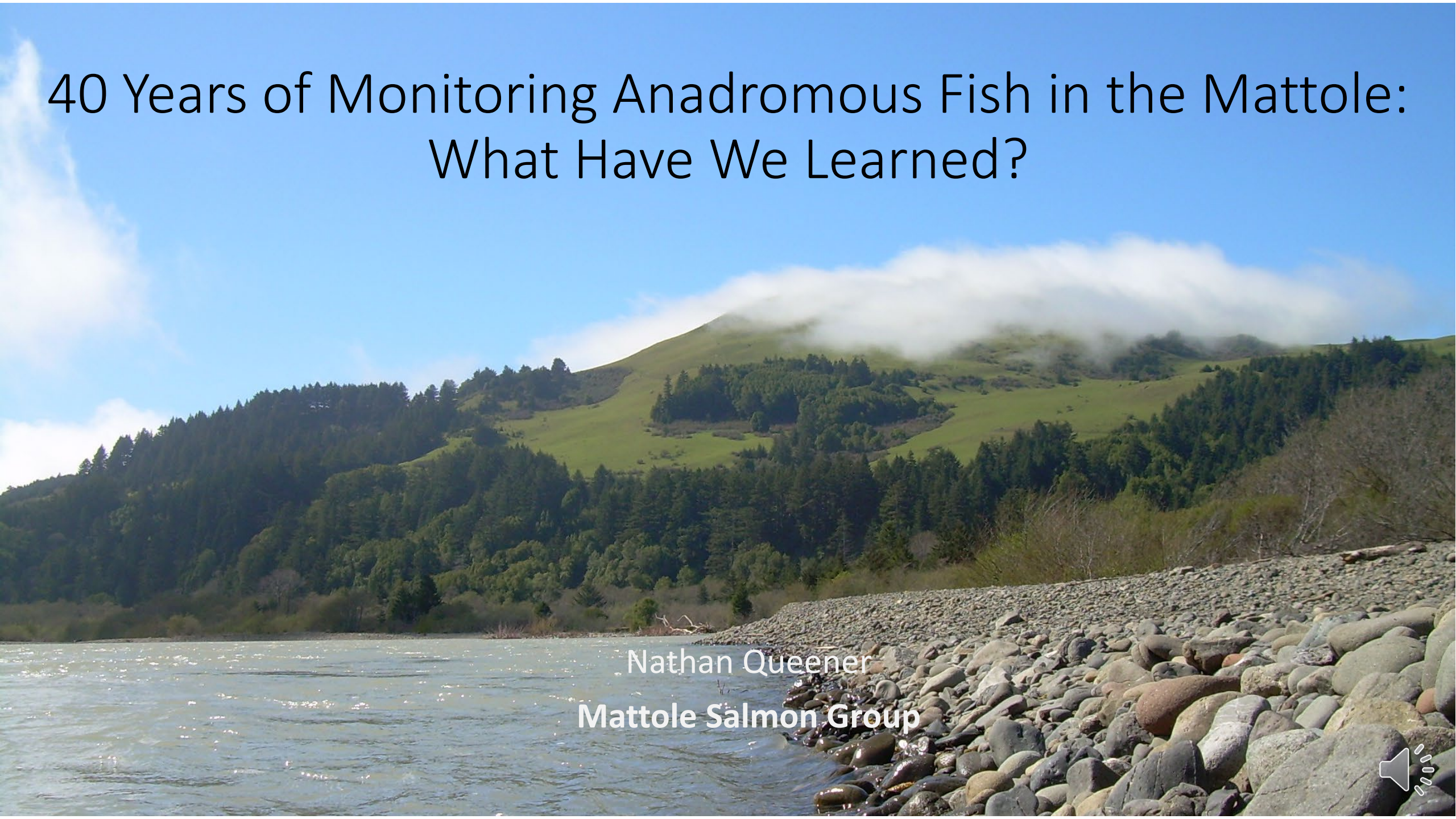
# 40 Years of Monitoring Anadromous Fish in the Mattole: What Have We Learned?

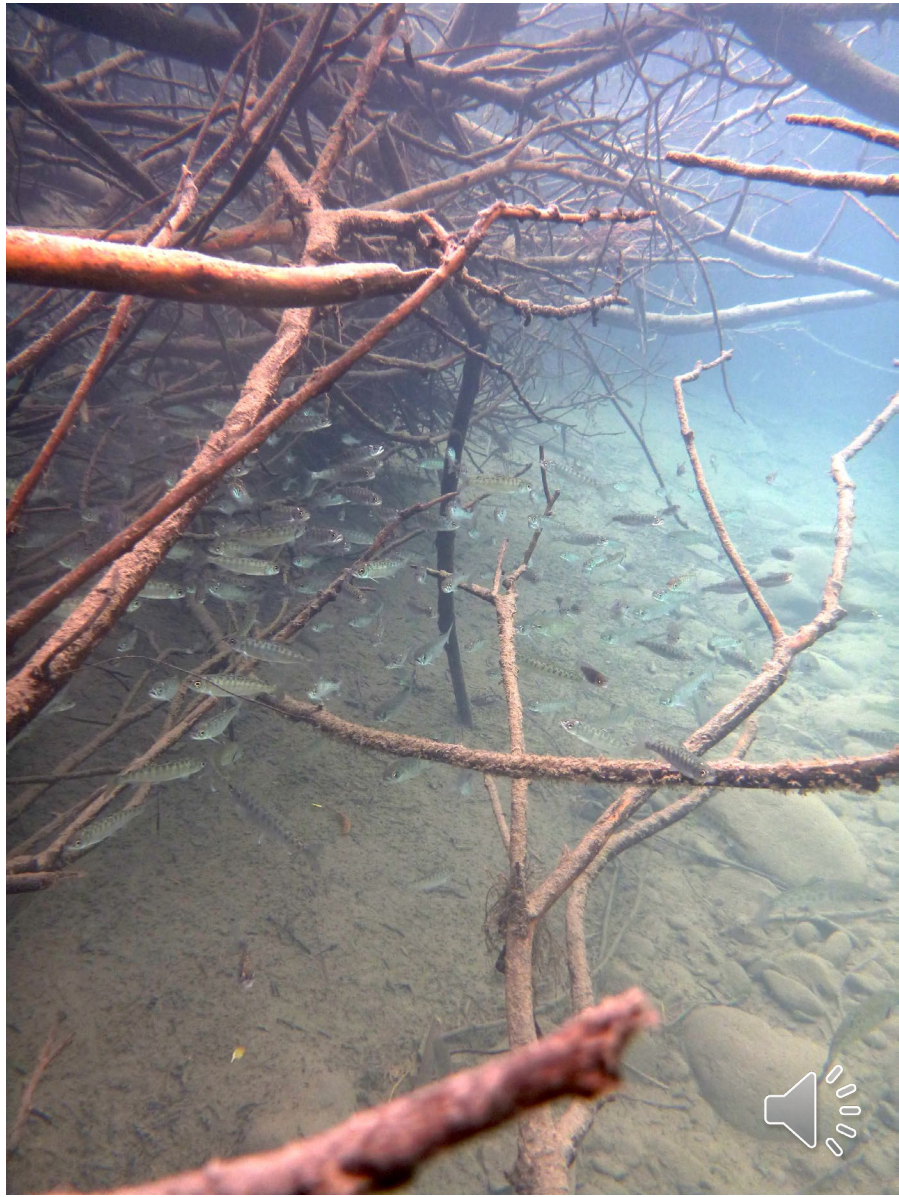


Nathan Queener

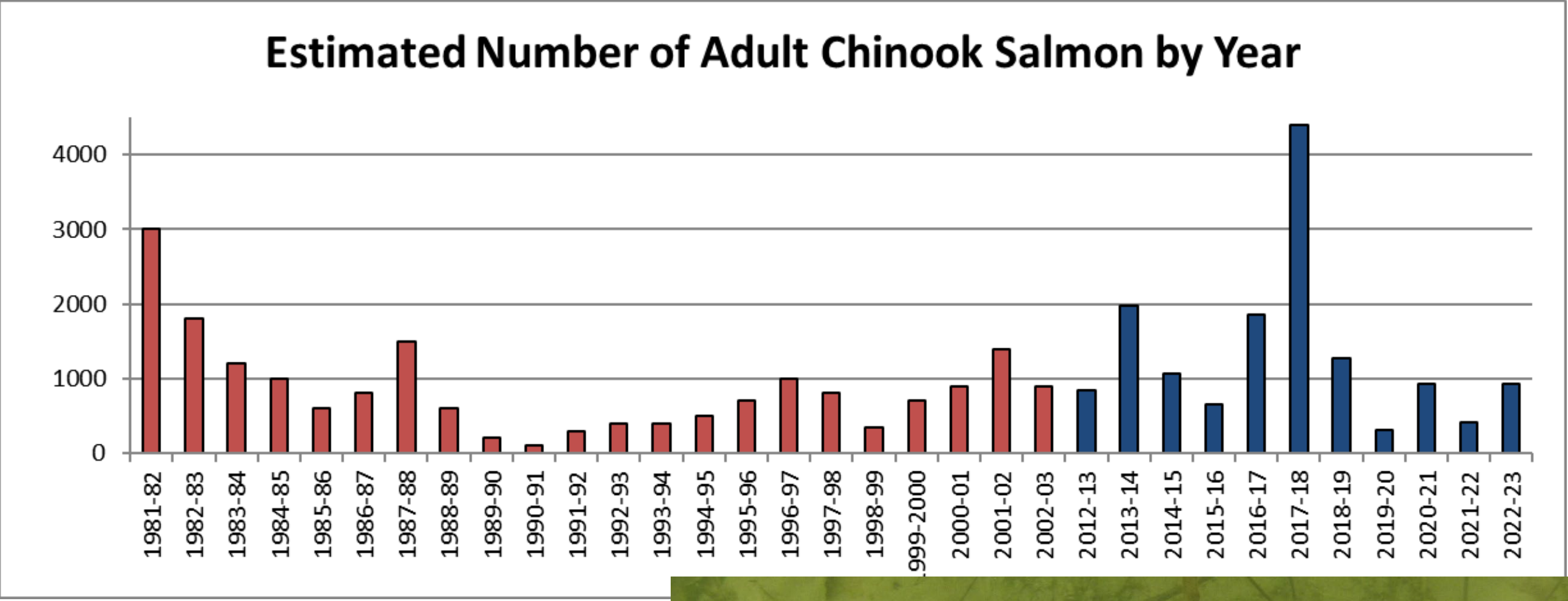
**Mattole Salmon Group**

# “Current” (~Last Decade) Status of Mattole Steelhead, Chinook, and Coho

- **Chinook Salmon**
  - Median estimate of adults from 304 (2019) to 4,404 (2017)
  - Depensation level: 178 adults
  - Federal Recovery Target: 4,000 adults
- **Steelhead**
  - Annual returns likely 2,000-5,000 adults
  - Juvenile fish broadly distributed, probably 95%+ of historic range
  - Depensation level: 614 adults
  - Federal Recovery Target: 12,300 adults
- **Coho salmon**
  - Less than 50 adults annually since 2009 (well below depensation)
  - Spawning almost entirely restricted to <10% of watershed
  - Depensation level: 250 adults
  - Federal Recovery Target: 6,500 adults

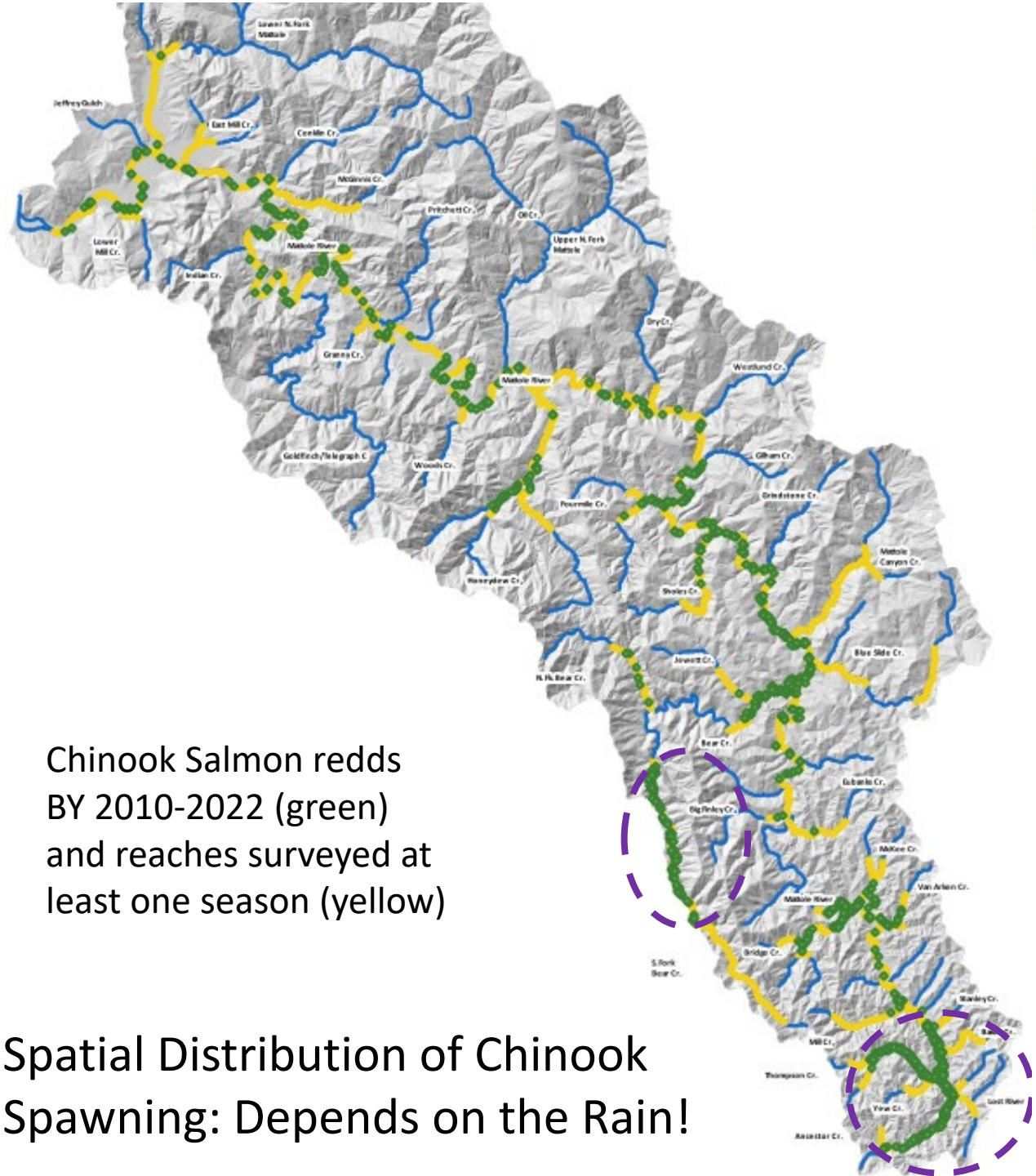


# Estimated Number of Adult Chinook Salmon by Year

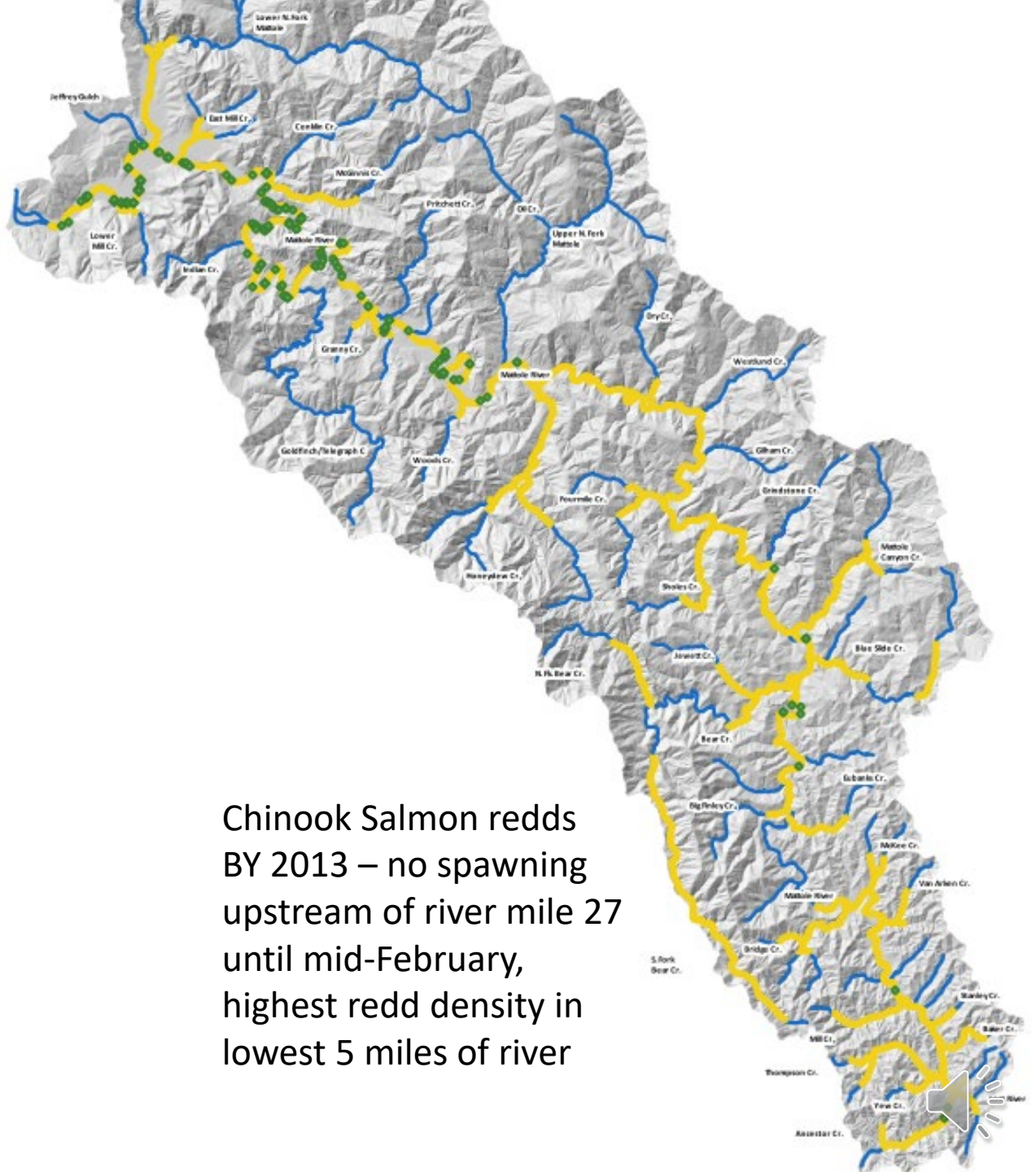



Average BY 2012-2018: **1,725** adults

Average BY 2019-2022: **646** adults
(2019 - 304)

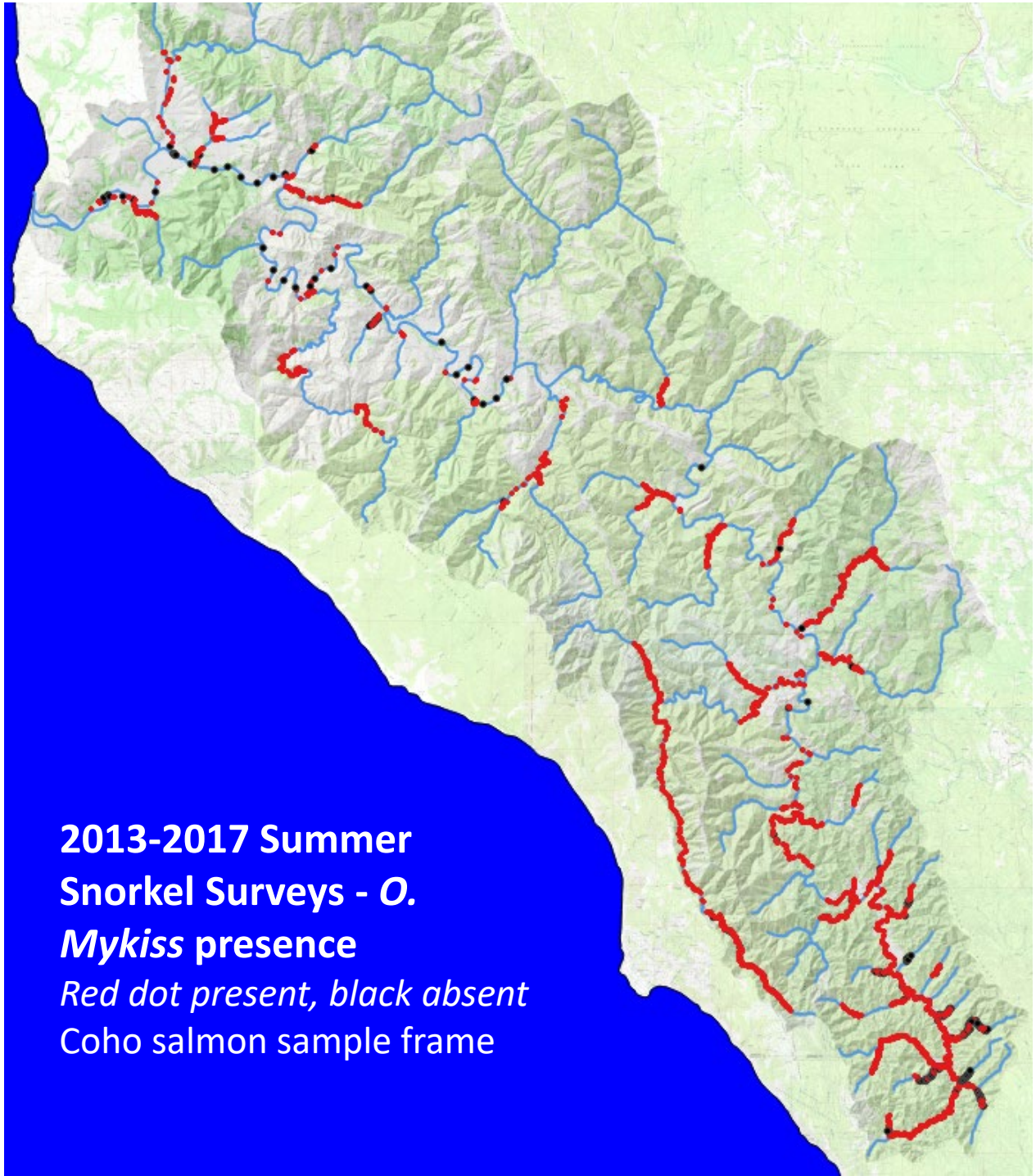



Chinook Salmon redds
BY 2010-2022 (green)
and reaches surveyed at
least one season (yellow)

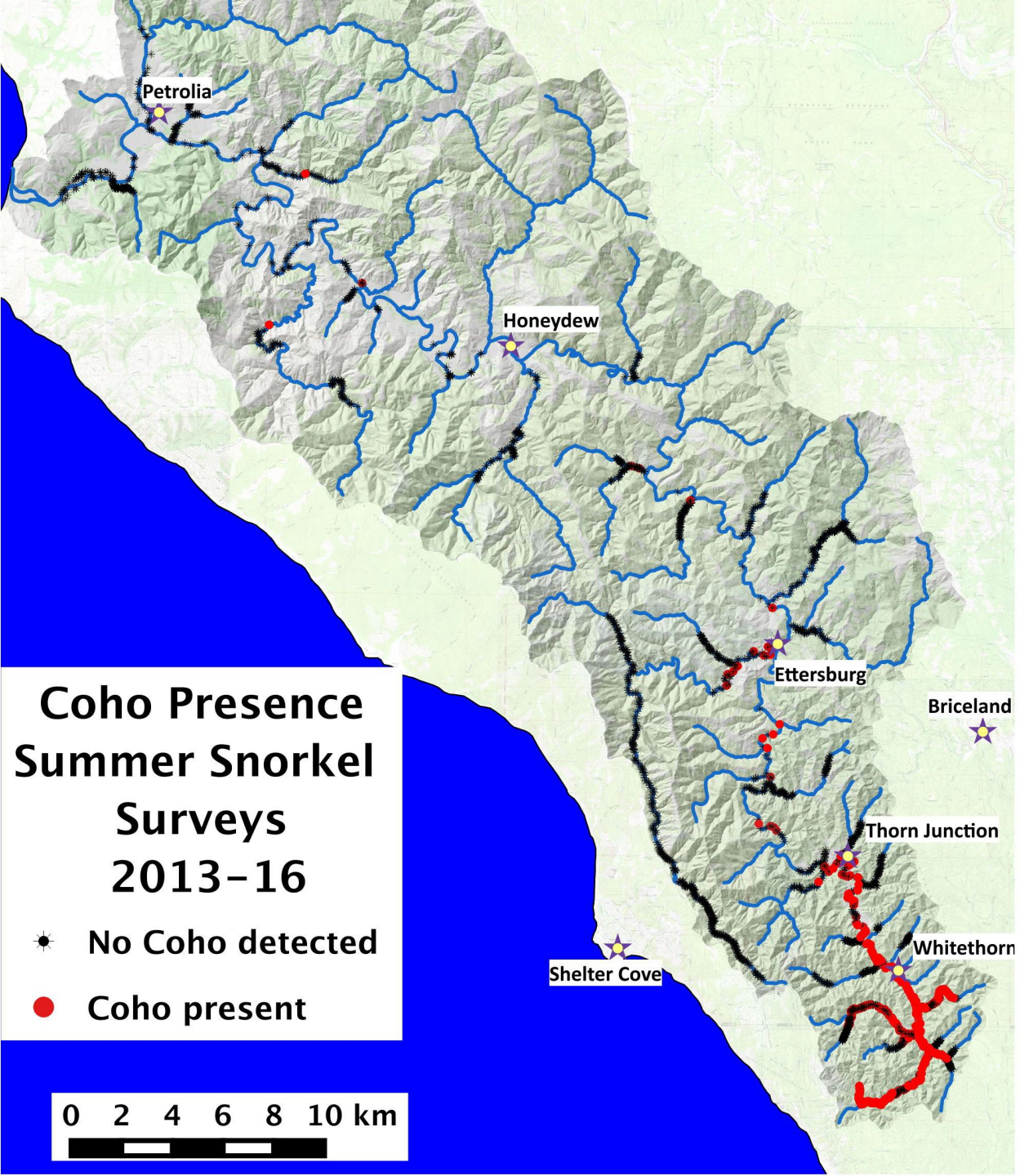



Chinook Salmon redds
BY 2013 – no spawning
upstream of river mile 27
until mid-February,
highest redd density in
lowest 5 miles of river

# Spatial Distribution of Chinook Spawning: Depends on the Rain!




- Juvenile Steelhead (*O. mykiss)* broadly distributed (anywhere there's water!)
- 2013-17 Percent Area Occupied ranged from 82-95% (3,919 pools surveyed).
- Annual mean pool count of parr across all reaches ranged from 22-45

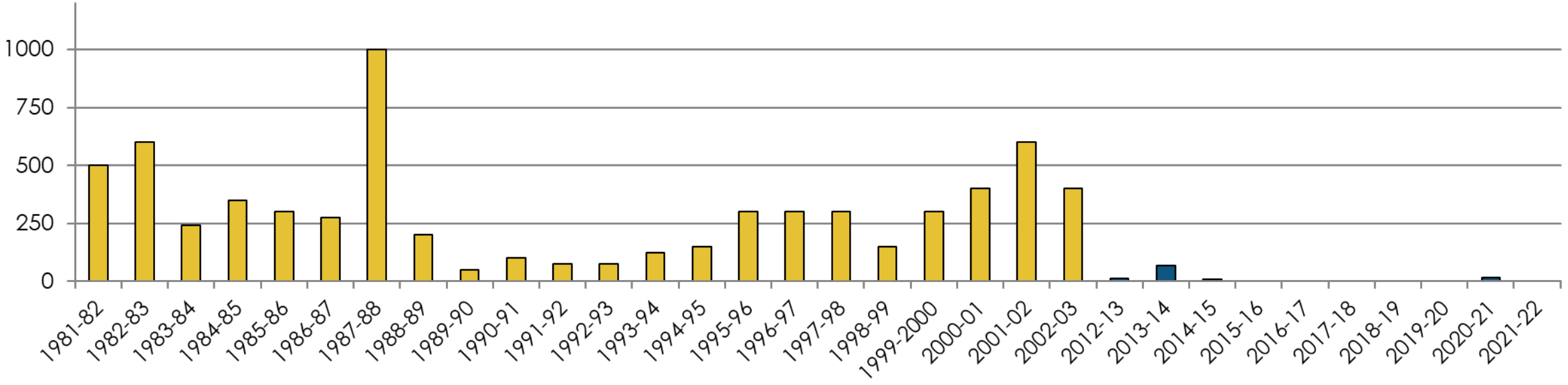



- 2013-17 summer snorkel surveys coho percent area occupied (PAO) range: 3-13%

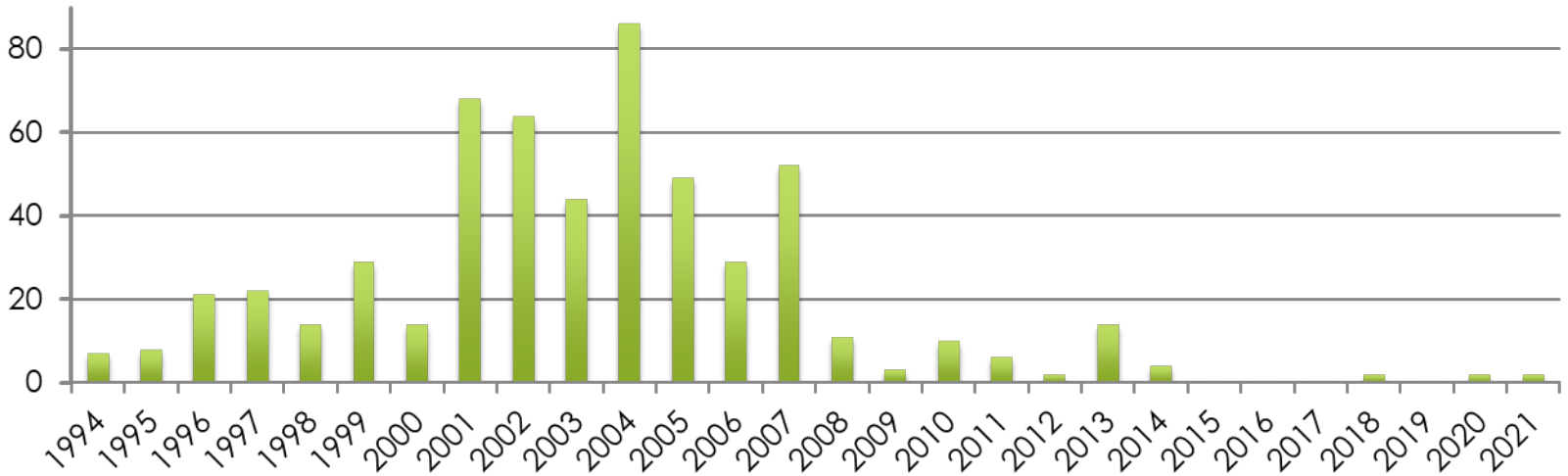
  93% of coho observed in only 7 of the 73 reaches surveyed, all upstream of Whitethorn

  >90% of coho spawning and summer rearing in 5% of the watershed!

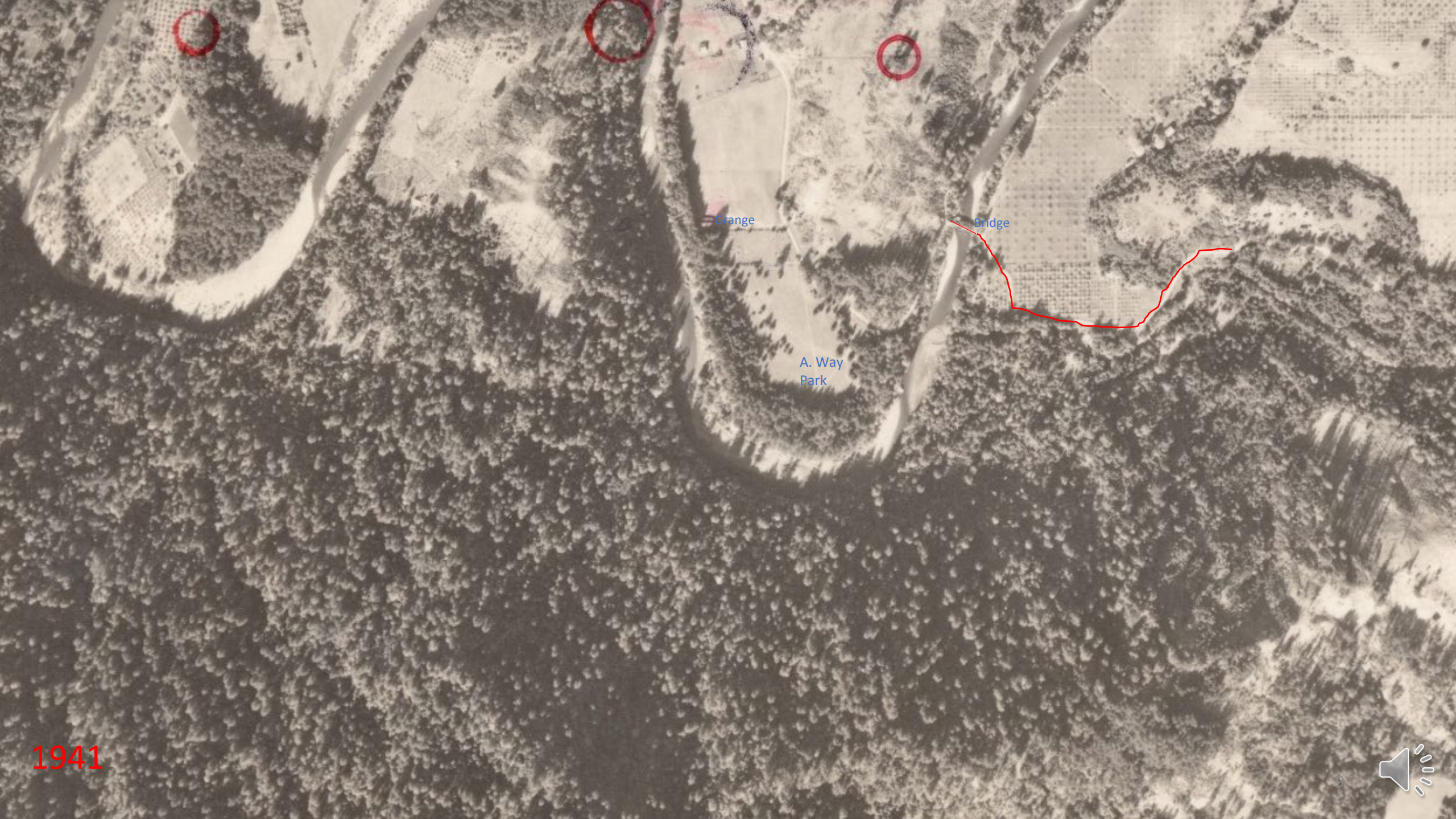
## Estimated Number of Adult Coho Salmon by Year
## Mattole Watershed, 1981-2002 and 2012-2021




## Adult live coho salmon, Mattole River
## Raw count from spawner surveys 1994-2021




| Mattole Summer Snorkel Surveys for Coho Parr Abundance 2012-2021 | | | |
|---|---|---|---|
| Survey Season | Coho Parr Observed | Naïve Abundance Estimate | Possible # of Female Spawners, 250 parr/redd |
| 2013 | 1204 | 2408 | 10 |
| 2014 | 684 | 1368 | 5 |
| 2015 | 1712 | 3424 | 14 |
| 2016 | 1070 | 2140 | 9 |
| 2017 | 233 | 466 | 2 |
| 2018 | 1130 | 2260 | 9 |
| 2019 | 367 | 734 | 3 |
| 2020 | 1046 | 2092 | 8 |
| 2021 | 2764 | 5528 | 22 |
| 2022 | ~2700 | ~5400 | ~22 |


Grange
Bridge
A. Way
Park
1941


Grange
A. Way
Park
1965


April 2019
Google Earth

# Current Restoration Priorities can all be traced in part to the confluence of historic floods and un-regulated tractor logging of the 1950s-1970s

- Excessive instream sediment, especially fine sediment (sand and silt)
- Lack of instream wood and low recruitment potential for future wood (young, hardwood dominated riparian)
- Low summer flows, that appear to be declining over time

Mattole Canyon Creek near Ettersburg, August 2007

Offshore sediment deposition rate in 1960s-70s nearly 3x any other period in last 500 years! Combination of widespread haphazard tractor logging + large flood events led to epic sediment movement. Sediment transport has since declined, but remains elevated compared to pre-1950.

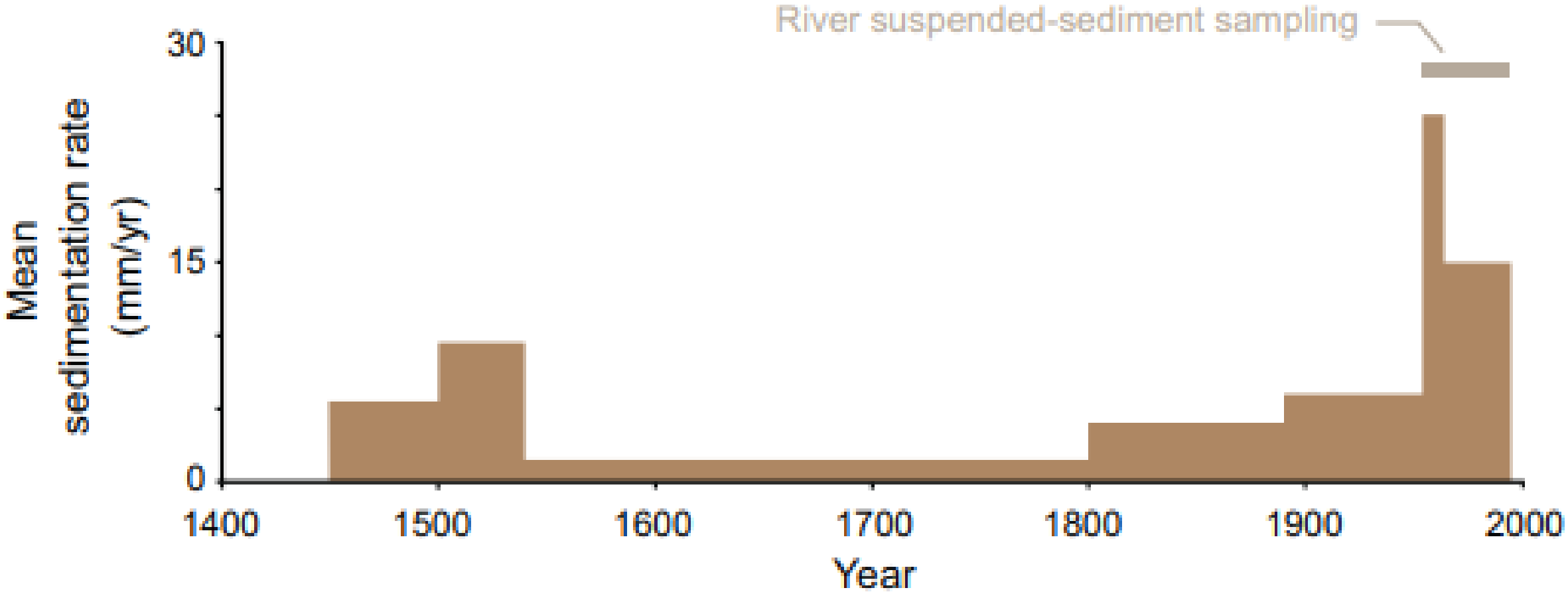
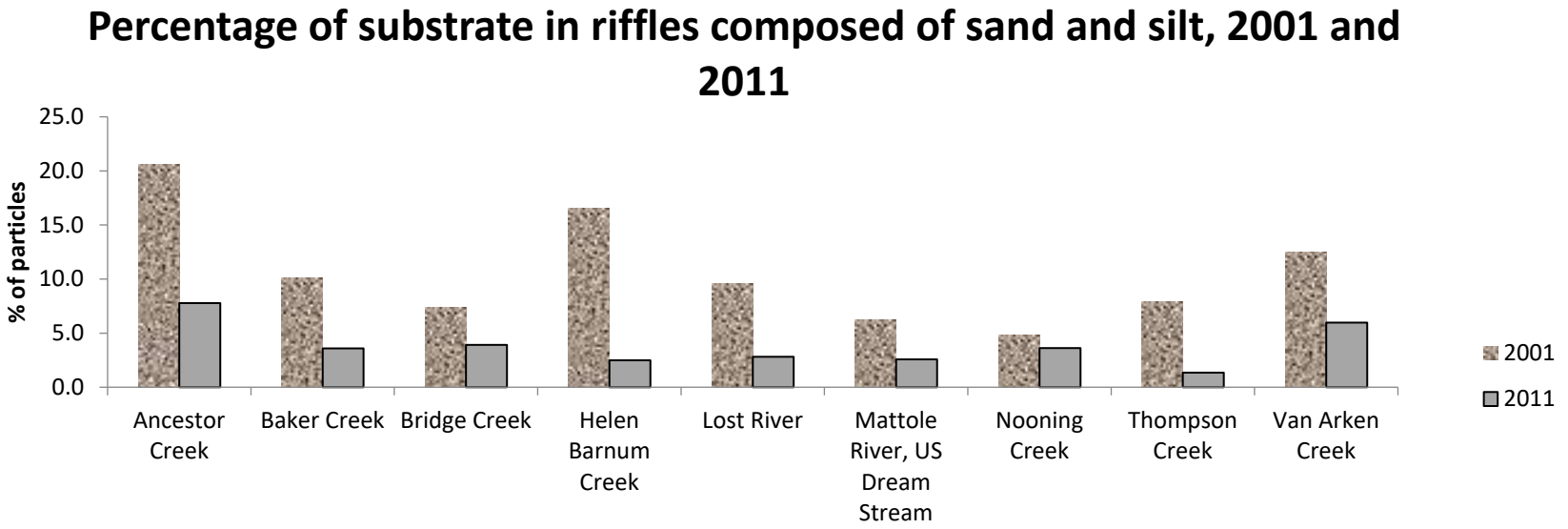



**Fig. 14.** Mean sedimentation rate on the continental shelf offshore of the northern California rivers between 1450 and 1995 after Sommerfield et al. (2002).

From: Warrick, J.A., M.A. Madej, M.A. Goñi, and R.A. Wheatcroft. 2013. Trends in the suspended-sediment yields of coastal rivers of northern California, 1955–2010. Journal of Hydrology 489: 108-123.

# Fine Sediment, 2001 and 2011

- Based on pebble count data, decrease in % of riffle surface sediment <2 mm (p-value=<0.05 at 8 of 9 sites)
- Very low values, all <10%



# Instream sediment throughout much of the watershed seems to be declining: What are the implications for fish?

- Greater chance of spawning success (especially for Chinook?)
- Less embedded substrate as cover/refuge for juvenile steelhead
- Alder/willow establishment and persistence in larger channels – more alcoves, thermal heterogeneity
- Estuary/lagoon surface area is increasing
- In the absence of instream wood, some channels incise and coarsen – lack of spawning gravel, floodplain connectivity, sediment storage
- Areas with clay rich mélange seem slower to recover – coincides with most of the lowest gradient habitat in northern 2/3rds of watershed

Mattole River, torrent sedge, and Chinook redd downstream of Ettersburg at river mile~35, November 2021

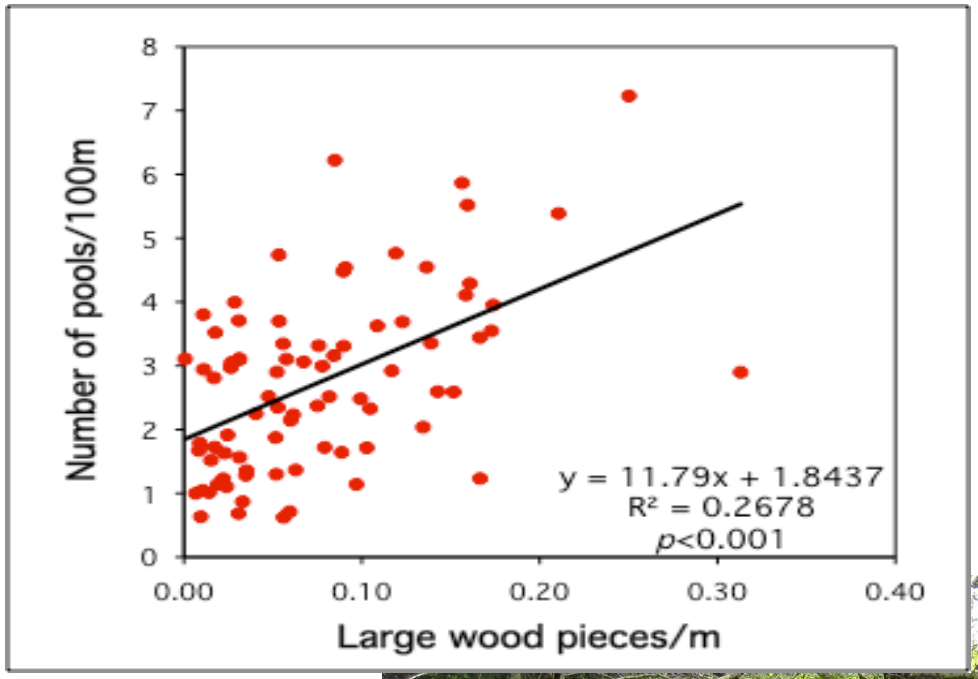
# Disappearing Wood?

- Over 70% of Mattole's forest harvested 1950-1975

- Areas harvested prior to sufficient riparian protection won't contribute effective wood to streams for decades

- Decay rate of 1.5% annually=60% decline in 40 years (Beechie et al. 2000)

- Stands in nearly all harvested streams <5m BFW should now be contributing effective wood, but in many larger streams decay may exceed recruitment for 2+ decades

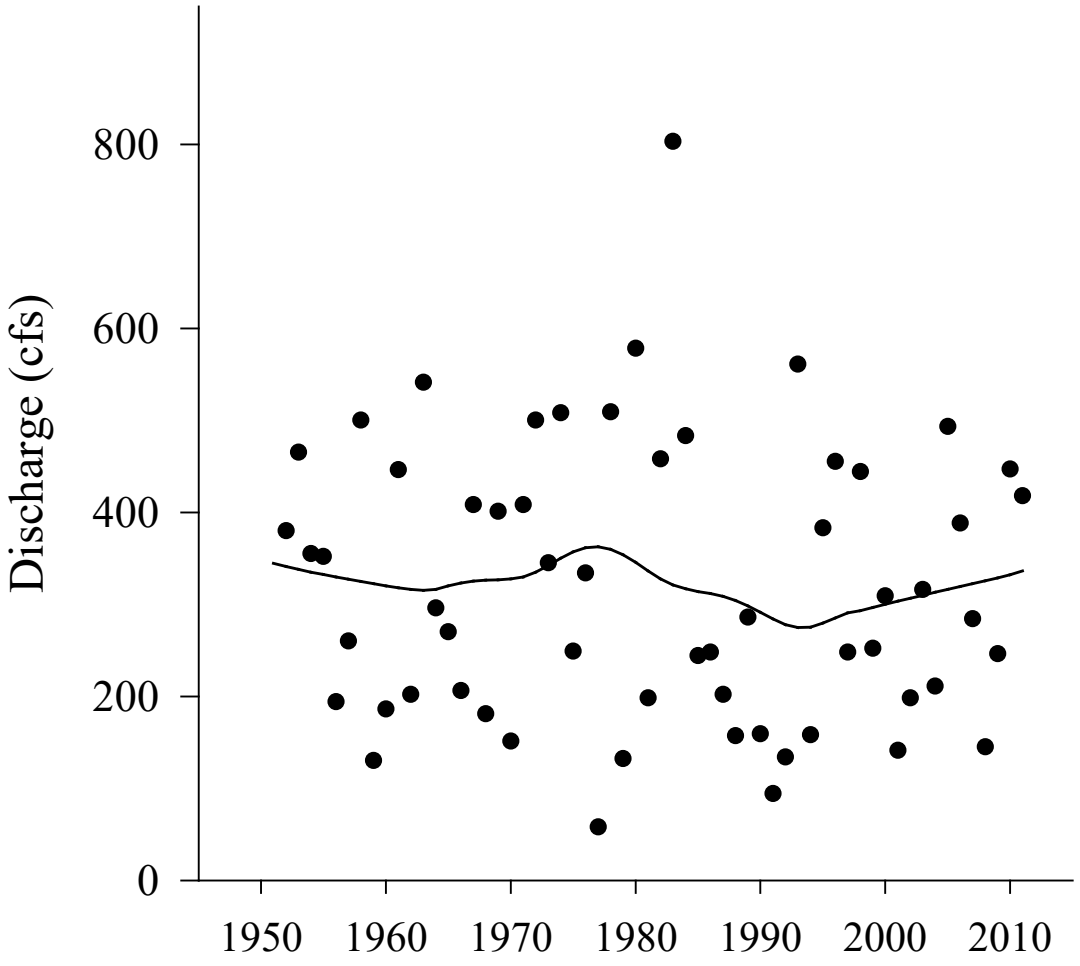



The Mattole has many miles of fish-bearing tributaries in semi-incised valleys with 2-3% gradient – most of these streams are currently “bowling alley” runs incising below flood terrace deposits from the 1960s-70s. Without instream wood these streams offer little to no habitat for coho or Chinook.

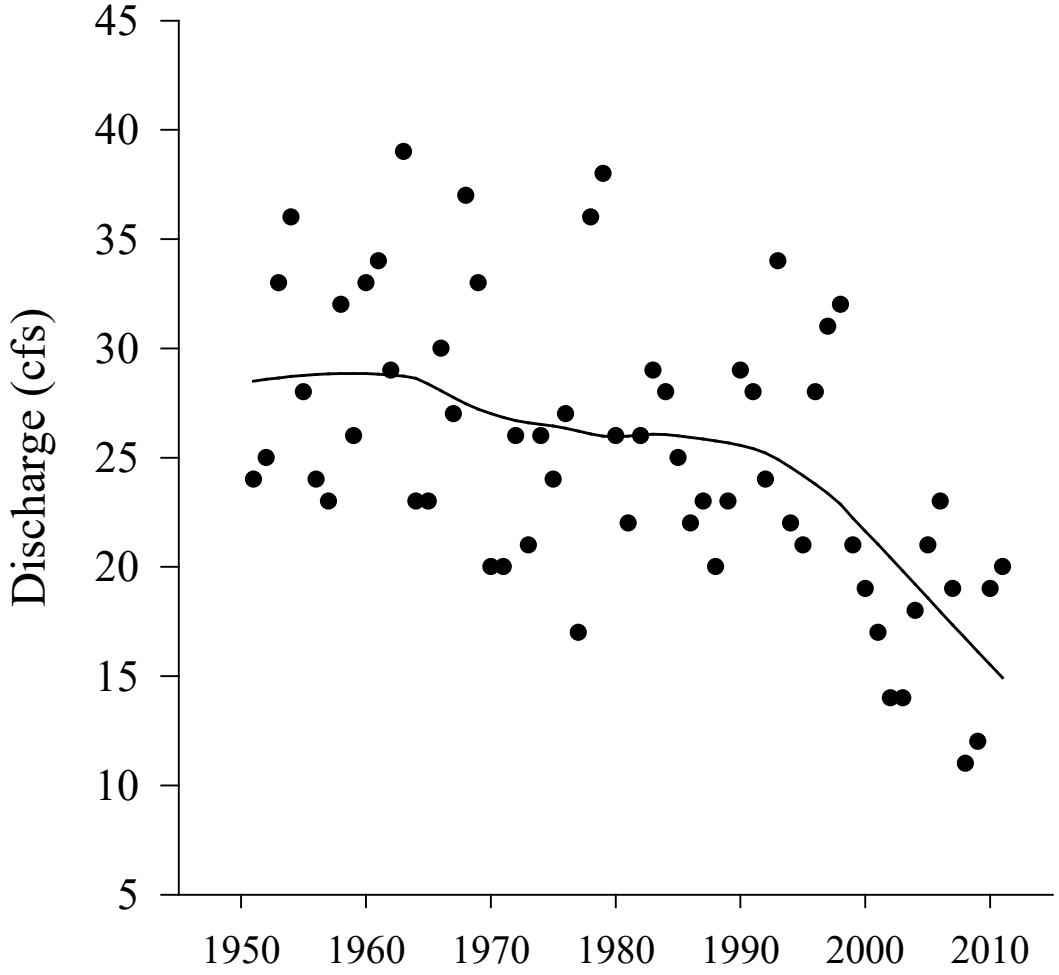
Sholes Creek Site. November 2020 post wood placement but prior to high flows (left), April 6 2021 (right), after desposition of spawning sized gravel

Same location in Sholes Creek as previous slide: Steelhead redd in deposited gravel, February 28, 2022

## Annual Median Flow at the Petrolia Gage




## Annual Minimum Flow at the Petrolia Gage




Low flows are getting lower - in some neighborhoods water conservation is essential to keeping water instream, but throughout the watershed forest condition and climate change are likely much more consequential

(graphs by John Williams)

Hot, low-streamflow summers like 2021 are rough on steelhead and coho in both tributaries (drying channel) and the mainstem Mattole (restricted to thermal refugia)

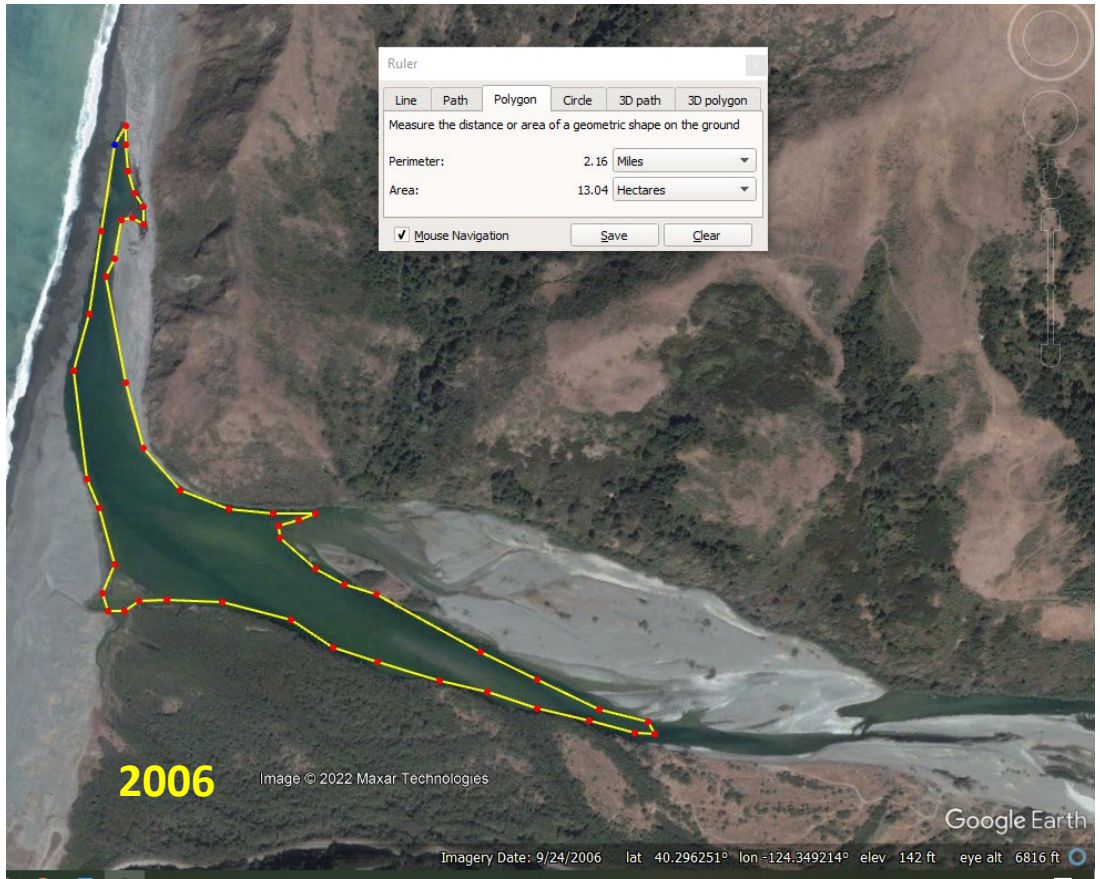
Sholes Creek, dry stream channel and dead steelhead parr, September 2021.

# Where can habitat quantity, quality, and capacity be increased to make more fish?

**Chinook Salmon**

– Where/what is the “floodplain fatty” habitat in the Mattole? What is the most valuable rearing habitat?

-How have changes in the estuary/lagoon affected Chinook rearing, especially over-summering as a life history strategy?

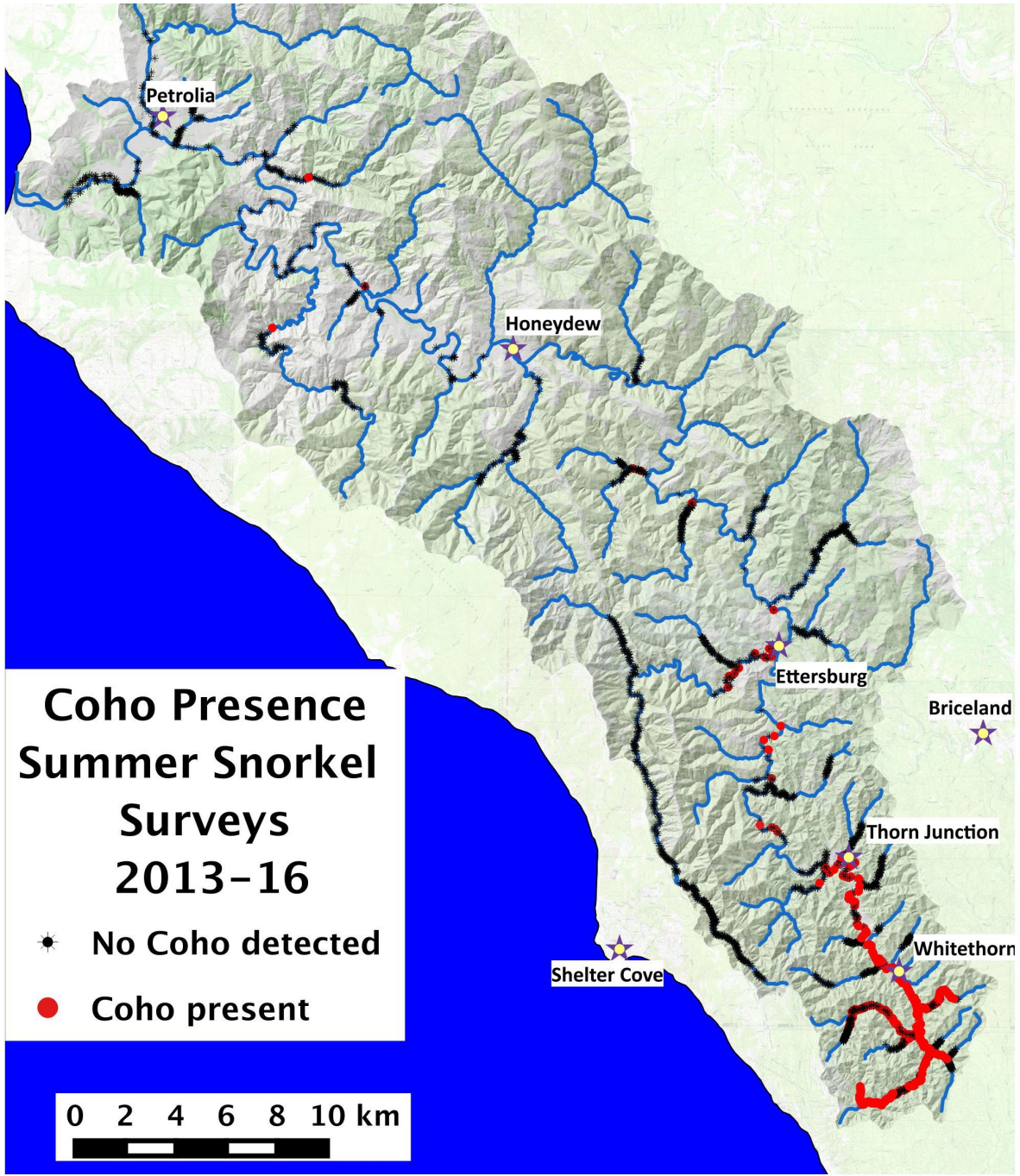


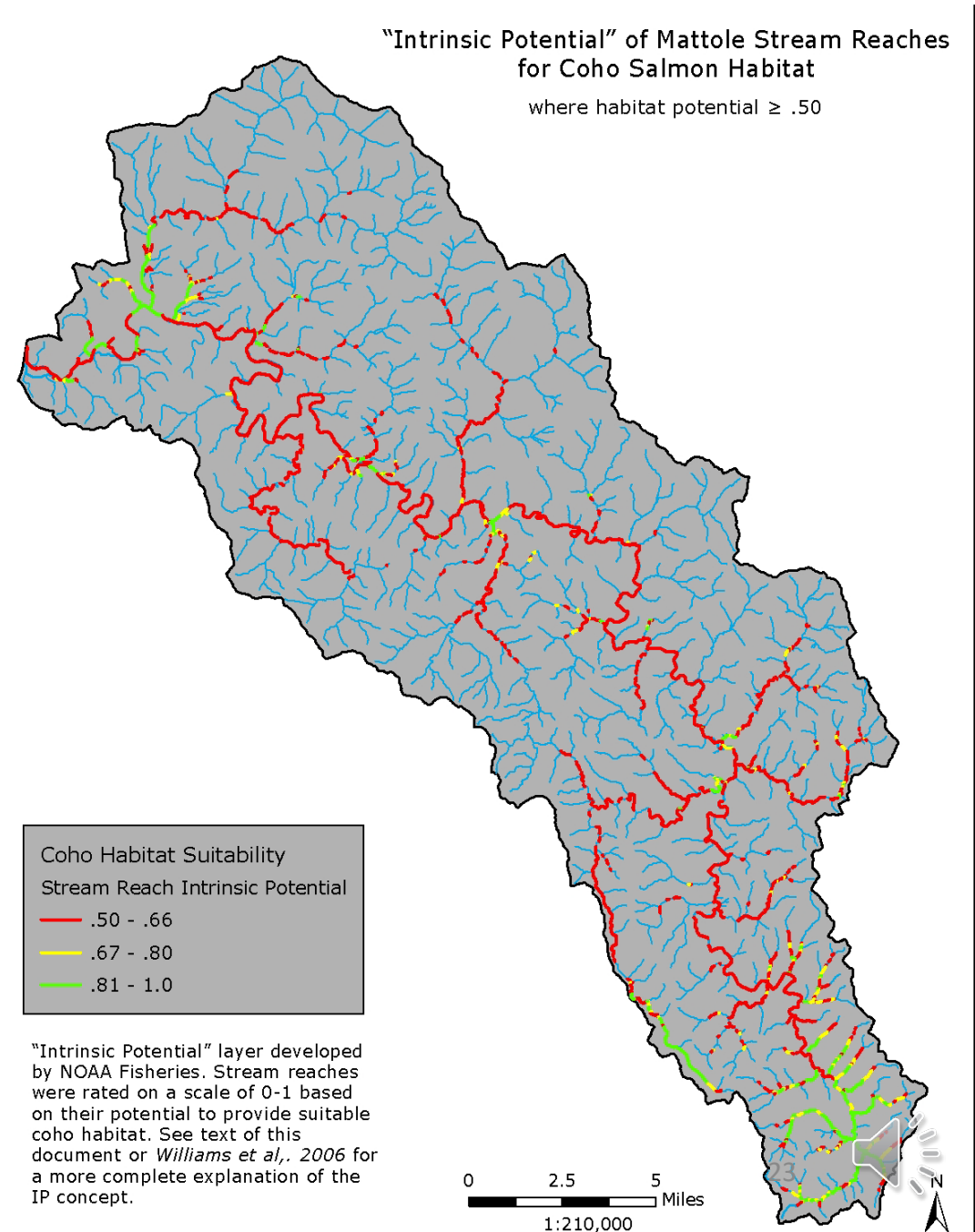

# Where can habitat quantity, quality, and capacity be increased to make more fish?

**Coho Salmon**

- Increase flows in the currently occupied or adjacent habitat – stay tuned for Tasha's presentation
- Where in the watershed could the population expand – need increase in spatial distribution to increase population?
- How/where downstream of Whitethorn can the mainstem support summer rearing – limits of thermal refugia?
- Are these non-natal coho biologically significant, or just cute?

# Where can habitat quantity, quality, and capacity be increased to make more fish?



# Where can habitat quantity, quality, and capacity be increased to make more fish?

**Steelhead**

- Most coho/Chinook restoration actions have some benefit for steelhead, but may only be marginal in some cases
- Availability and quality of thermal refugia in the lower ~45 miles of the mainstem is very important – essential for summer rearing at temps of >~23 C
- Increasing streamflow in tributaries across the landscape could have large benefits
- Streams with abundant summer flow  have high conservation value

One coho amidst a million steelhead in thermal refugia in Mattole River near Petrolia

**What socio-cultural conditions lead to forest conditions across the landscape that support abundant runs of anadromous fish?**