

Dutch Bill Creek salmonid use and habitat suitability

Salmonid Habitat Restoration Priorities Meeting

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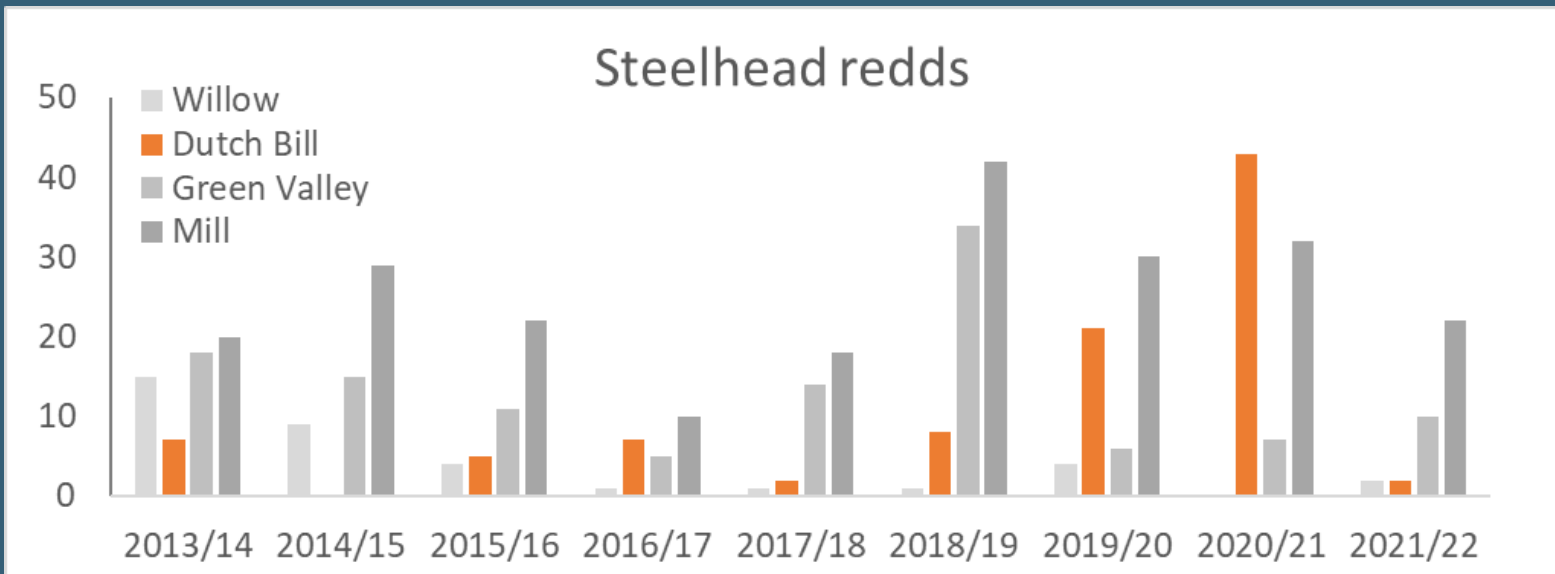
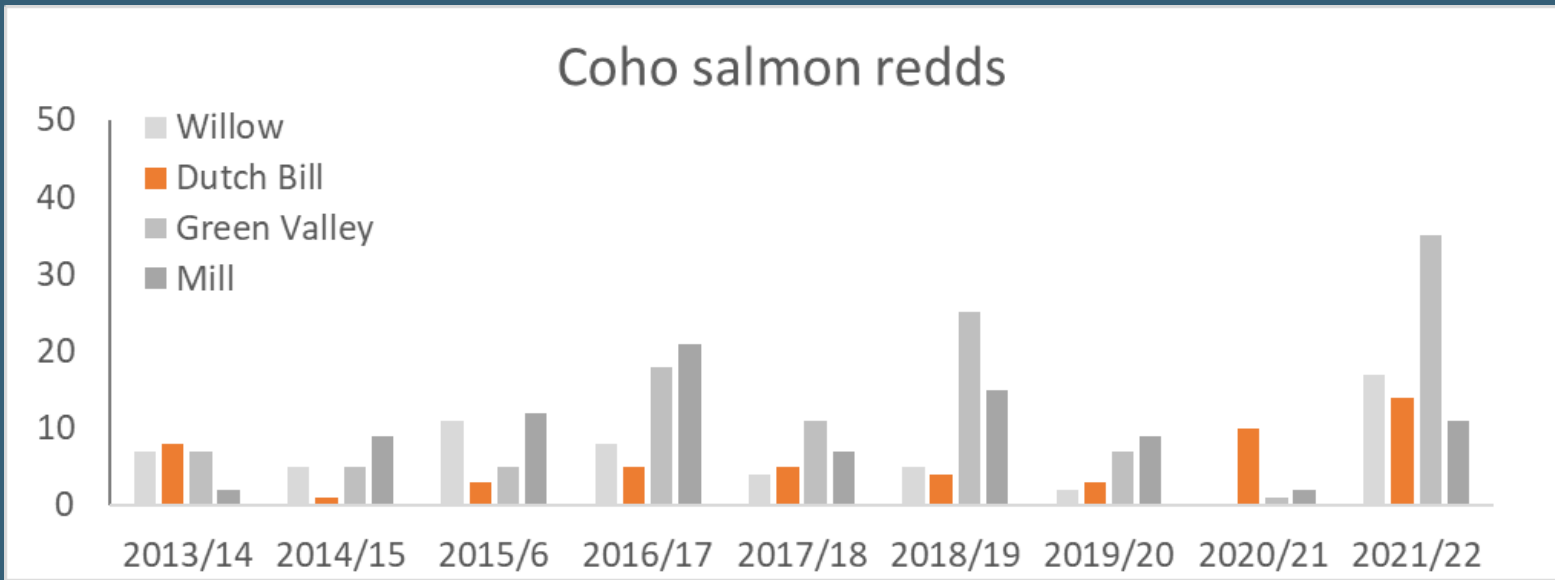
Introduction



- Data and outcomes CA Sea Grant and Sonoma Water's salmonid life-cycle monitoring, survival studies and summer habitat assessments over past \pm decade
- In most cases, data collection not designed to specifically assess SHaRP attributes, but we can draw conclusions or make assumptions about some attributes from data and observations

Dutch Bill Creek salmonid redd observations

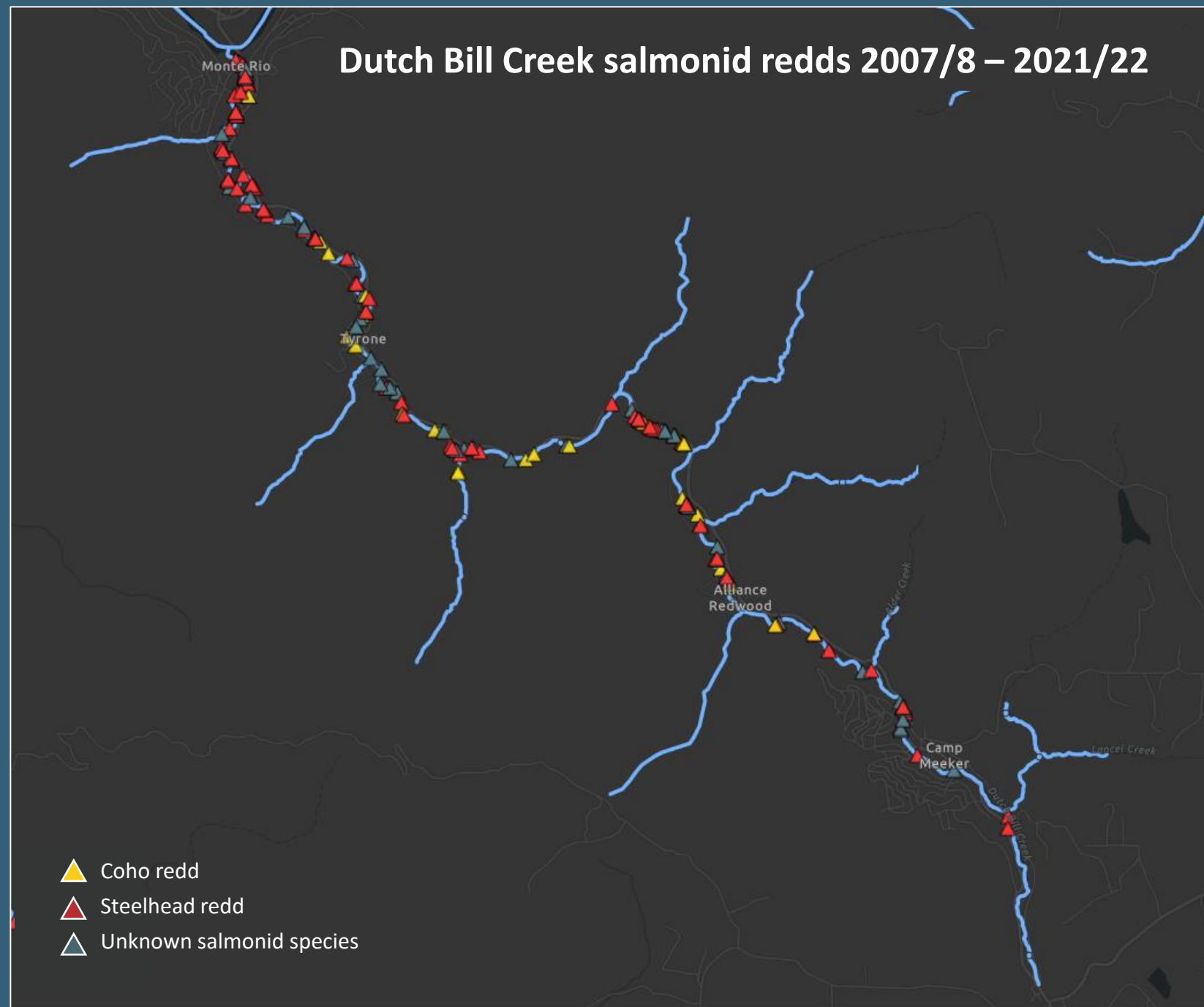
- Adult coho and steelhead return to Dutch Bill Creek nearly every year in variable numbers
- 17% of coho redds observed in 4 LCM/SHaRP streams in past 9 years were in Dutch Bill Creek
- 20% of steelhead redds observed in 4 LCM/SHaRP streams in past 9 years were in Dutch Bill Creek



Redds observed during Coastal Monitoring Program spawner surveys. In winters 2019/20 and 2020/21, steelhead redds in lower Dutch Bill likely influenced by adult releases of hatchery steelhead into Russian River.

Redd distribution

- Coho spawning distributed throughout stream to downstream of Alder Creek, generally highest densities middle section
- Steelhead spawn throughout stream to above upper Bohemian Hwy xing, generally higher densities in lowest reach



Impacts of water quantity on spawning

- During some winter drought years, such as 2013/14, adults not able to access spawning habitat in Dutch Bill Creek for much of the spawning season
- During winter drought of 2021, higher proportion of adult salmonids observed returning to Dutch Bill Creek, apparently influenced by limited accessibility to other streams throughout the lower basin
- Redd stranding: In winter of 2021/22, 7 of 14 redds observed (50%) became dry or partially dry during spawner season



Dry redd in lower Dutch Bill Creek

Spawning adults and redd success

➔ Attribute: Water Quantity

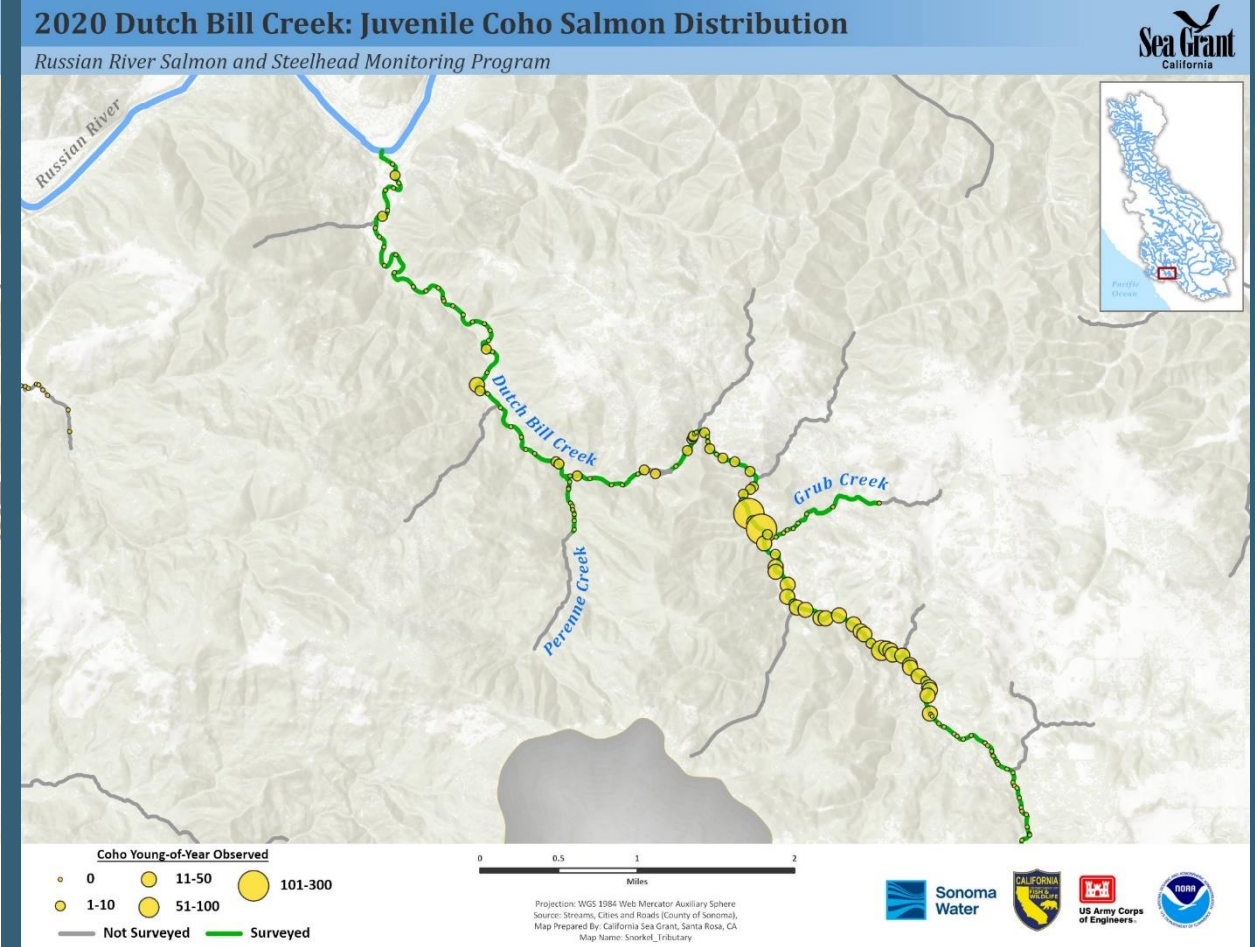
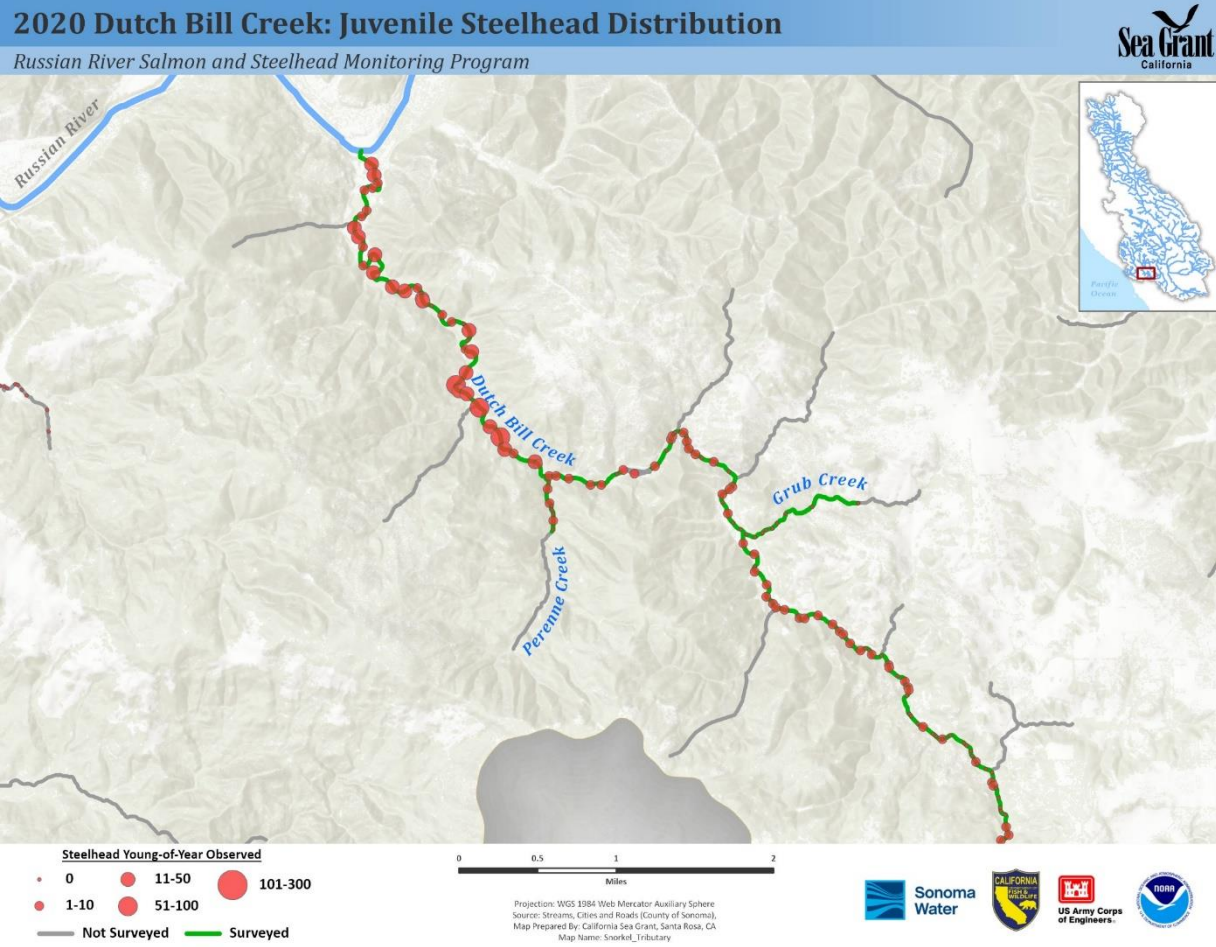
- **Key points:*

- *Salmonids spawning in all of Dutch Bill Creek*
- *Changing climate patterns, including later rainy season onset, increase in winter and spring drought conditions, and flashier storm events, are reducing spawning window and influencing spawning distribution patterns*
- *Some dry years returning adults cannot access stream due to low flows*
- *Other dry years fish can access lowest, low-gradient reach of Dutch Bill Creek earlier/longer than other streams in the basin and greater proportion of spawning may occur there*
- *Fish may be limited to spawning and rearing in lowest reach of Dutch Bill Creek in some years, as climate volatility increases*
- *In dry or flashy water years, redd sites can dry prior to fry emergence*



Coho spawning in Dutch Bill Creek

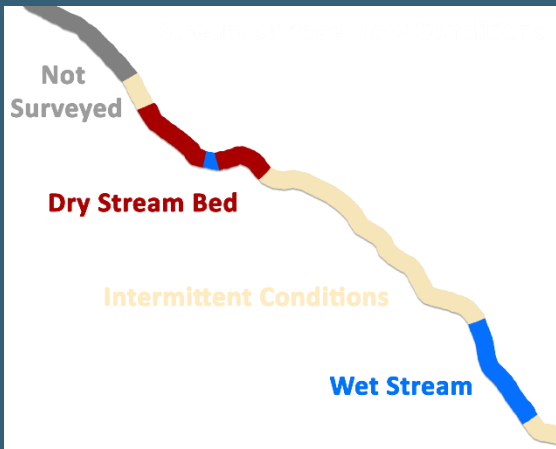
Young-of-the-year distribution: 2020



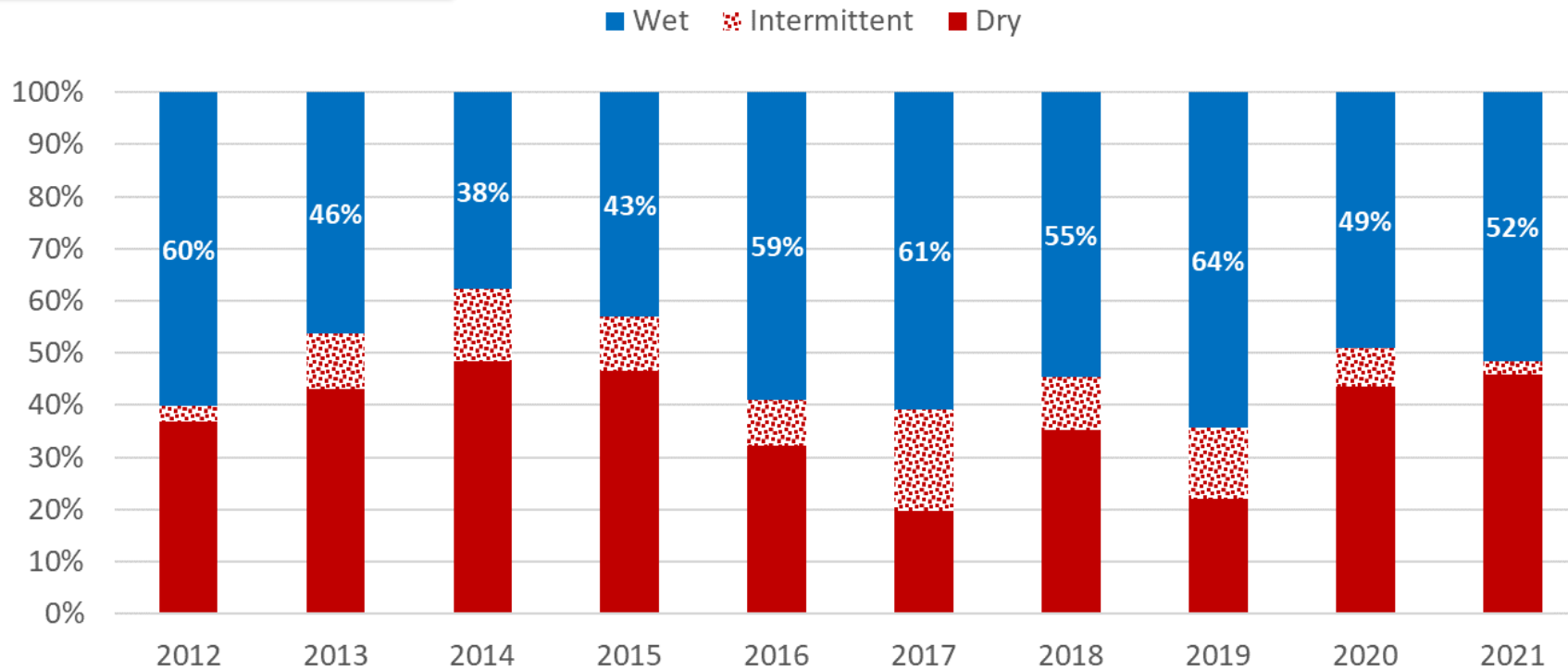
- Fish observed during summer 2020 Coastal Monitoring Program snorkel surveys
- Yoy distributed throughout the stream, density and distribution differs by year, highest coho density generally middle of stream
- ***Key point: Rearing occurs throughout all of stream**

Late-summer wetted habitat

➔ Attribute: Water Quantity



Dutch Bill Creek baseflow conditions



- On average over past 10 years, only 53% of Dutch Bill Creek stayed wet and connected,
- *Related to snorkel pools:*
 - *2021 - less than half of rearing fish seen in pools that stayed wet (47%)*

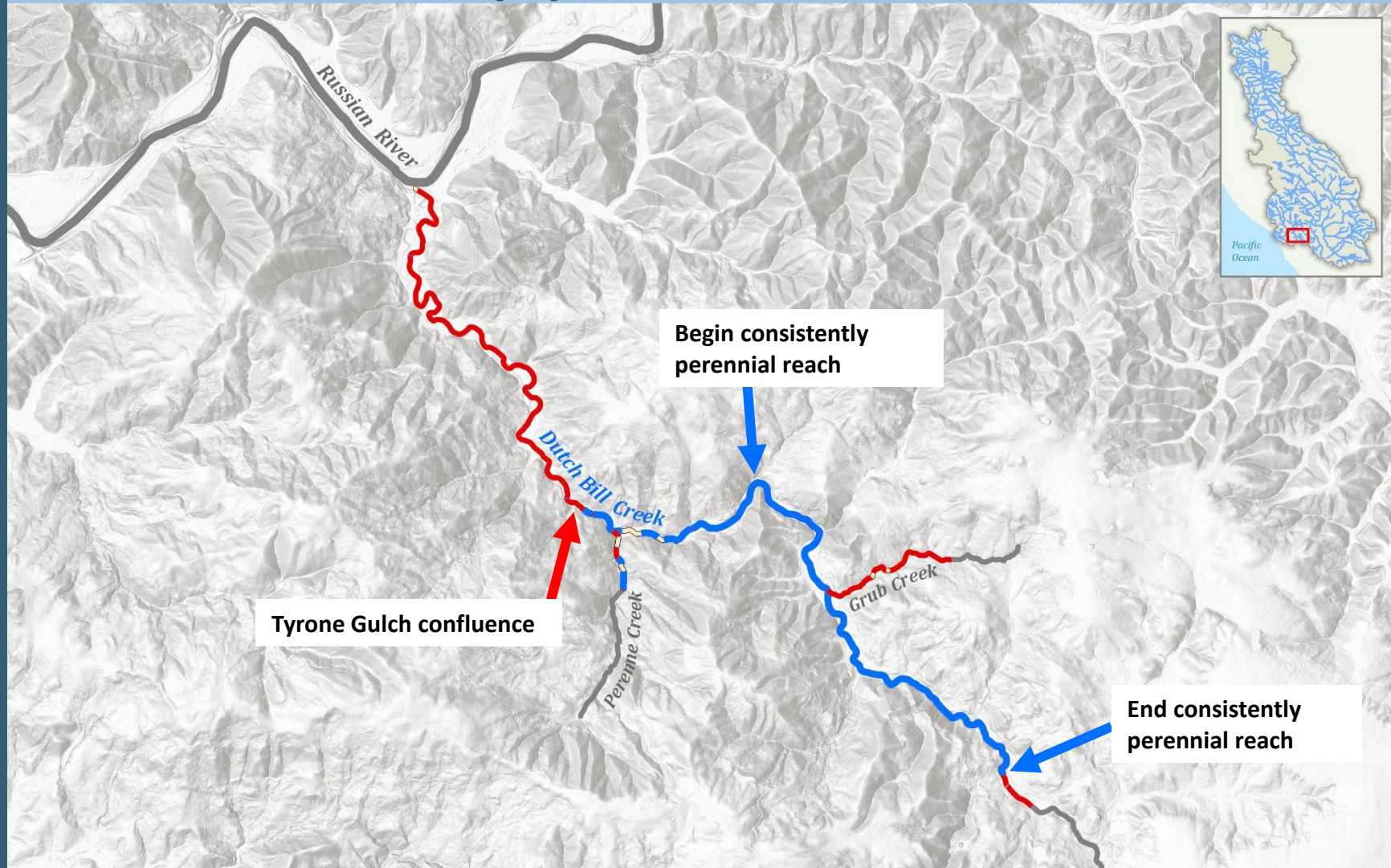
Total proportion of Dutch Bill Creek stream channel that is wet, dry, or intermittent at driest time of year. Flow release implemented in summers of 2015, 2016, 2018-2021. Length of channel sampled varied between years.

Wetted habitat distribution

- Consistent drying below Tyrone Gulch, even in 2019
- Reach above Bohemian Creek provides summer flow refugia, even in driest years surveyed

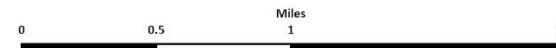
Dutch Bill Creek: 2021 Wetted Habitat

Russian River Salmon and Steelhead Monitoring Program



Surface Flow Condition
— Dry — Intermittent
— Wet — Not Surveyed

Surveys Conducted: October 6, 2021



Projection: NAD 1983 UTM Zone 10N
Source: Streams (County of Sonoma),
Map Prepared By: California Sea Grant, Santa Rosa, CA

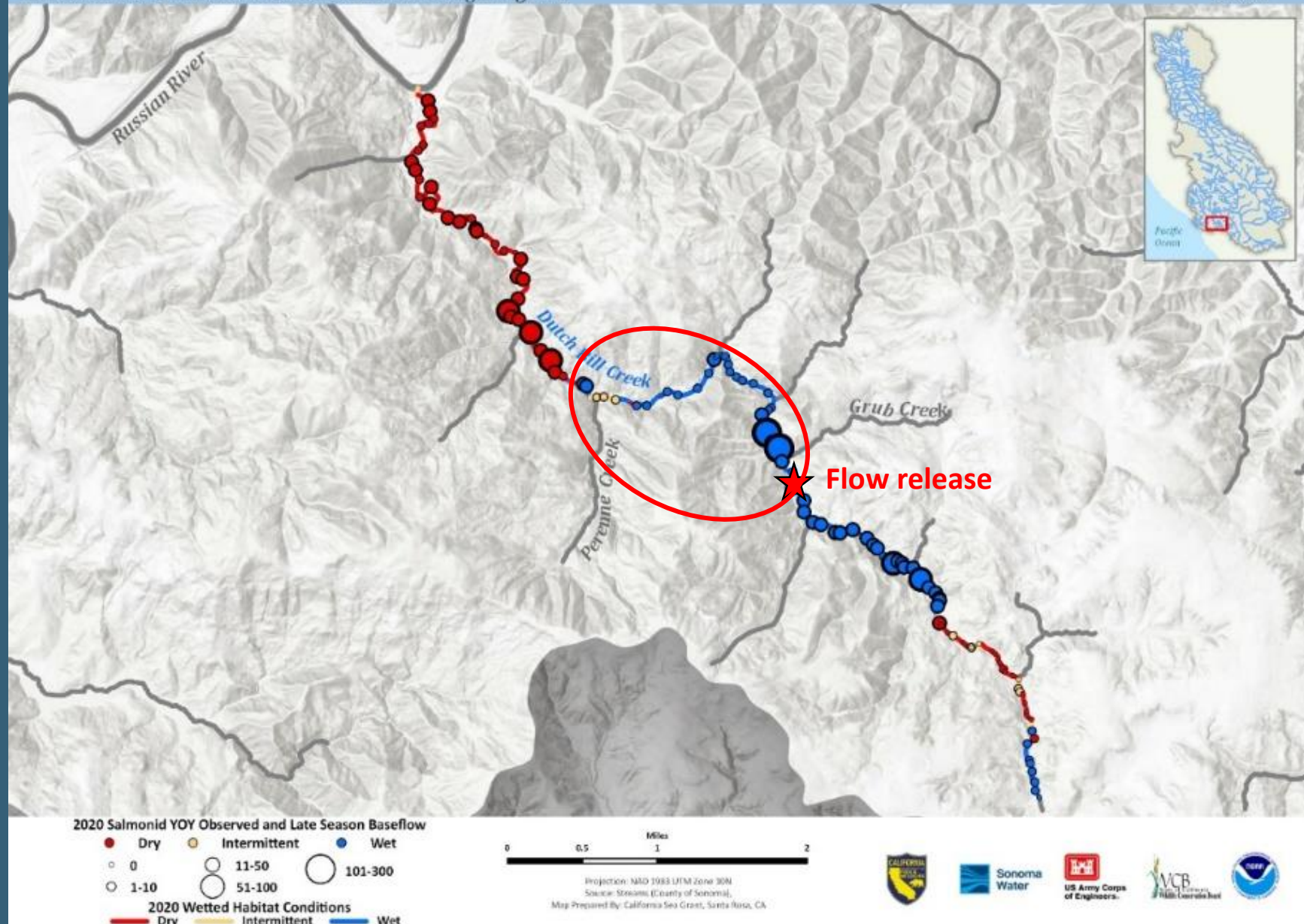


CMPRD flow augmentation

- Started summer 2015
- Increases wetted volume and connectivity every year initiated
- Impacts at least 3 rkm downstream
- Dissolved oxygen levels improved
- Earlier onset = greater positive effect

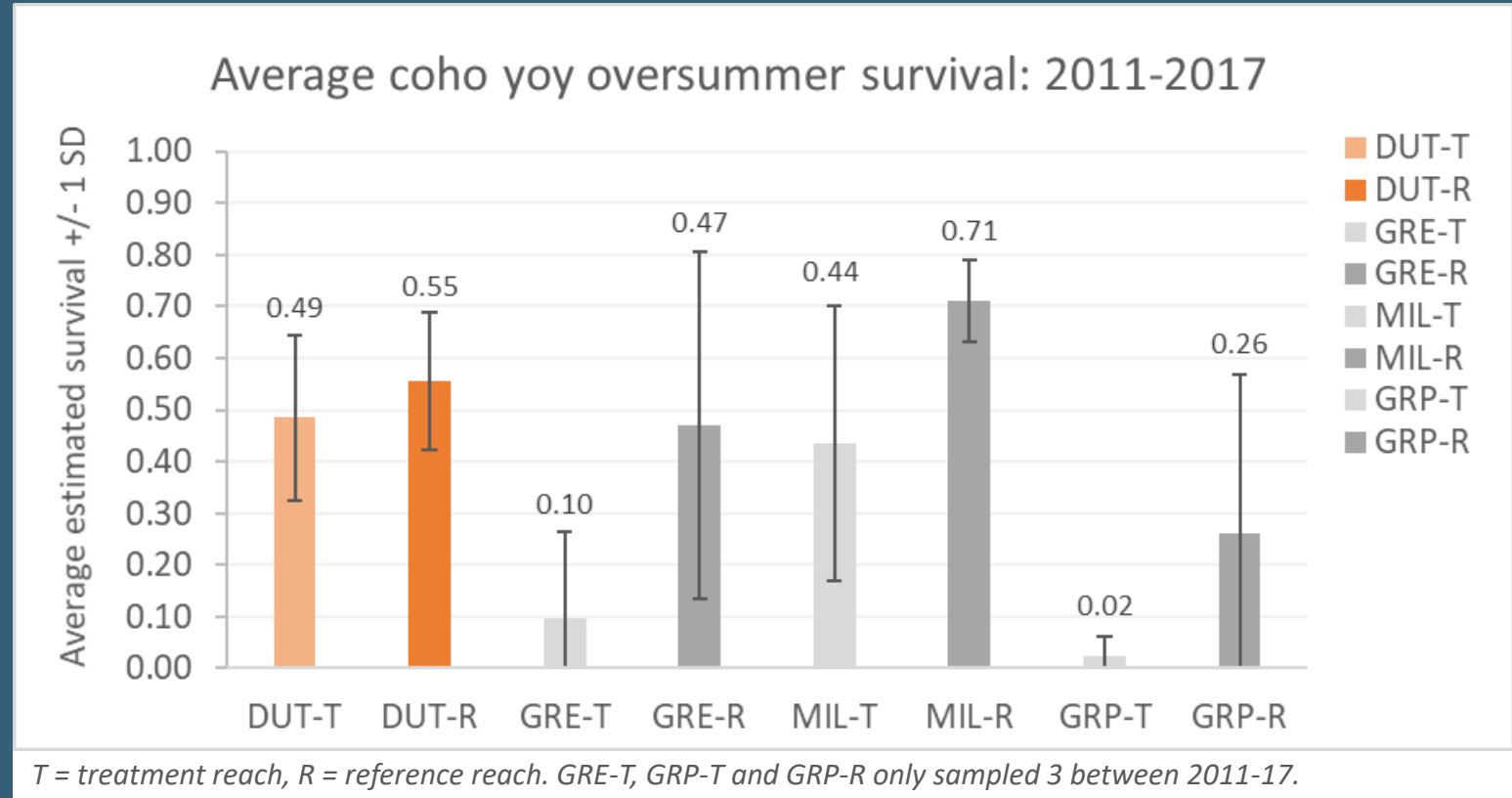
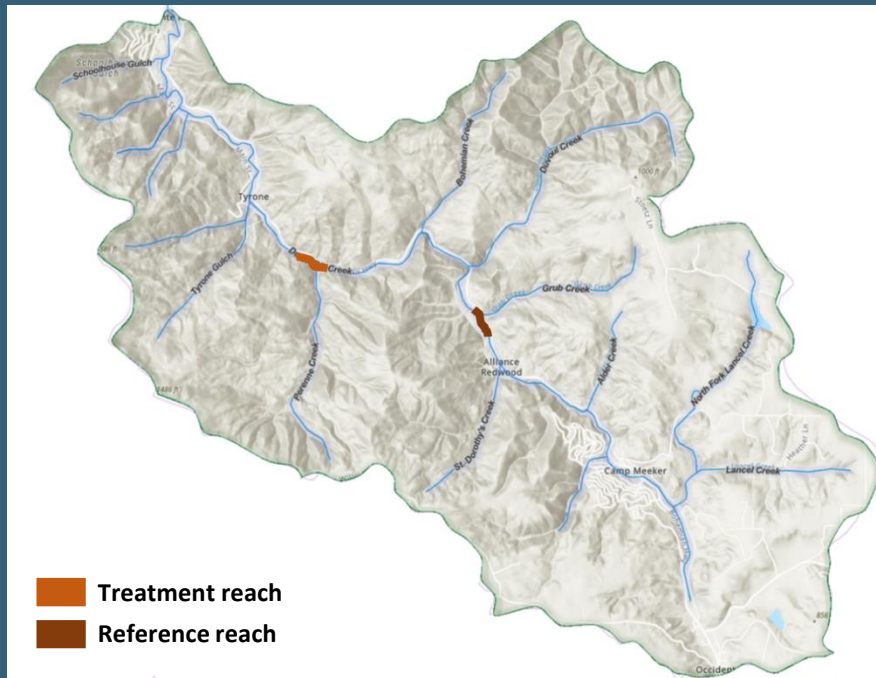
Dutch Bill Creek: 2020 Juvenile Salmonid Distribution & Wetted Habitat

Russian River Salmon and Steelhead Monitoring Program



Oversummer juvenile coho survival

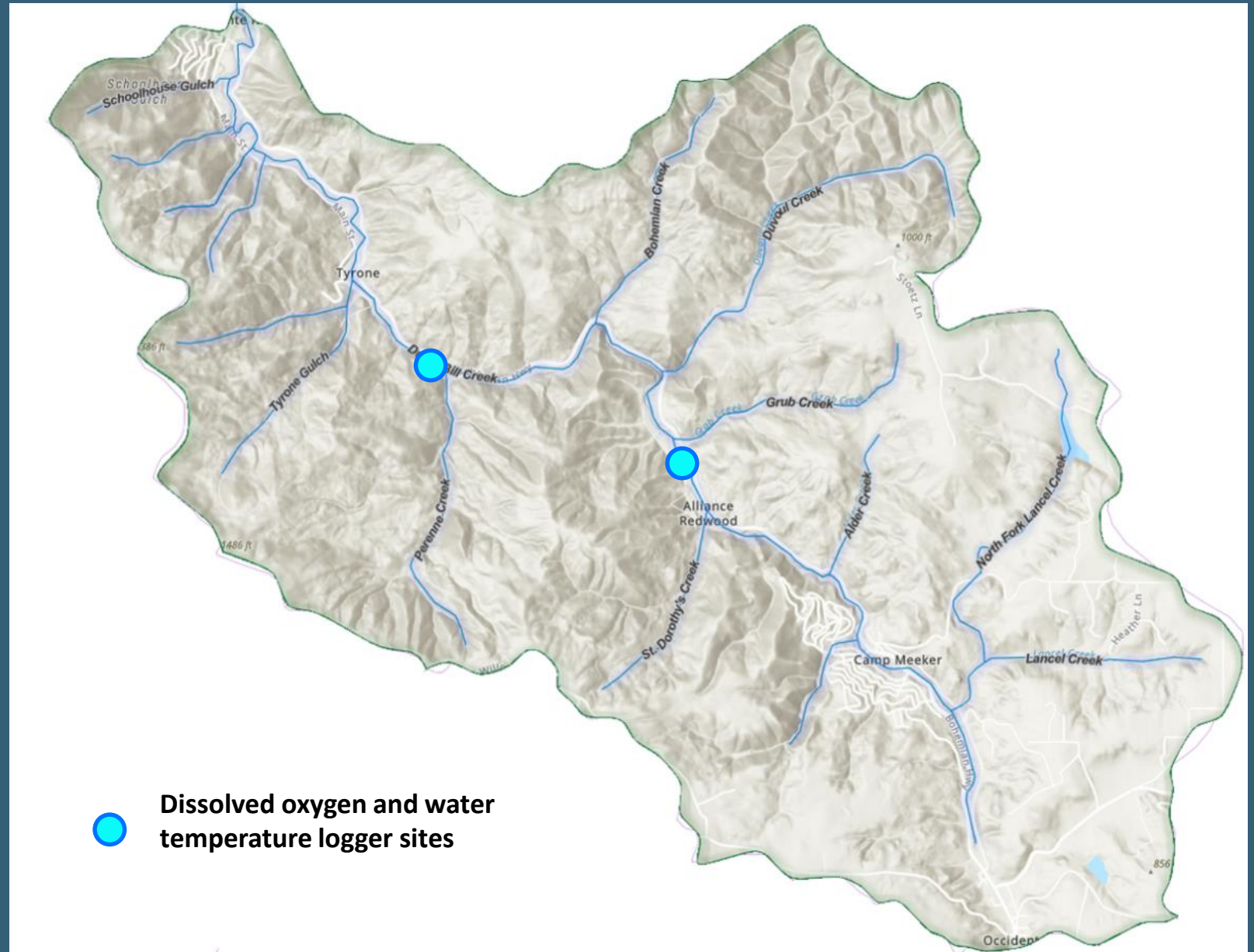
- Juvenile coho oversummer survival sampled in reference and treatment reaches of 4 streams (8 reaches) over 7 years



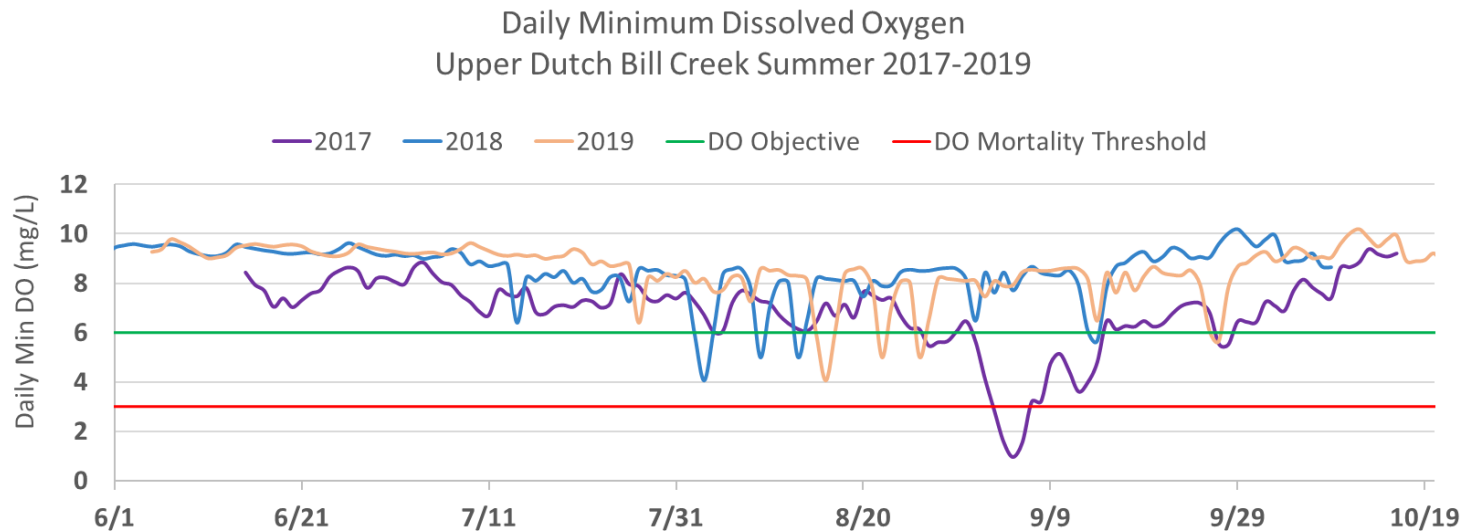
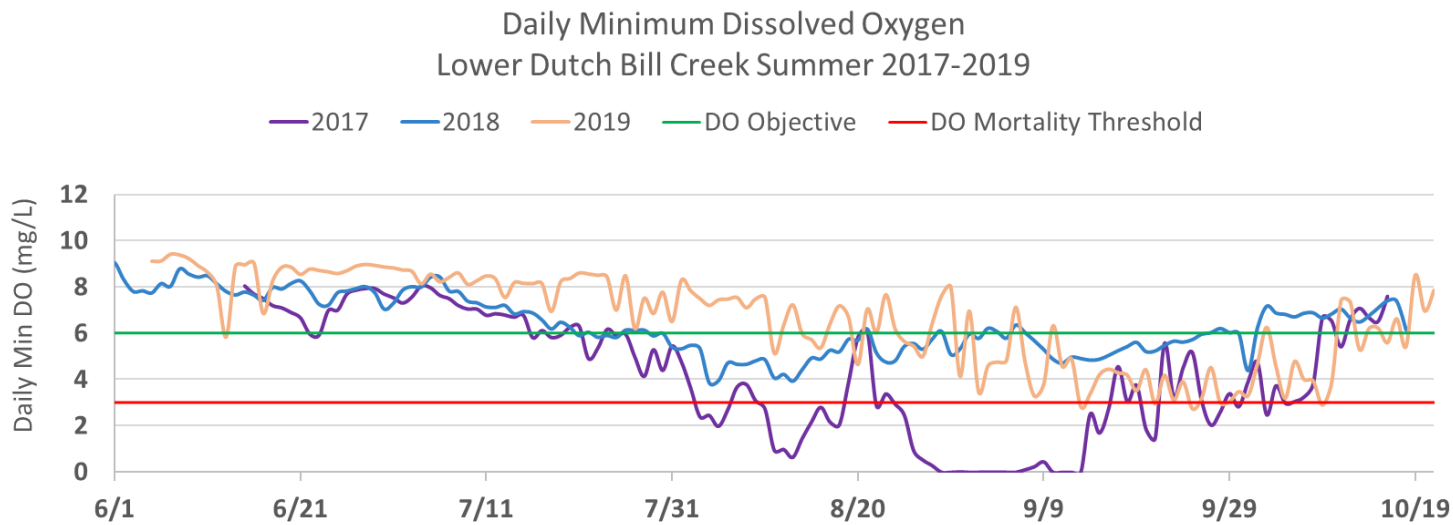
- Averaged over all years, Dutch Bill reaches had 2nd and 3rd highest survival
- Relatively low variation in survival

Summer water quality monitoring

- Gauging in 2 pools:
 - 2017-2019 dissolved oxygen
 - 2012-2020 water temperature



Summer Dissolved oxygen

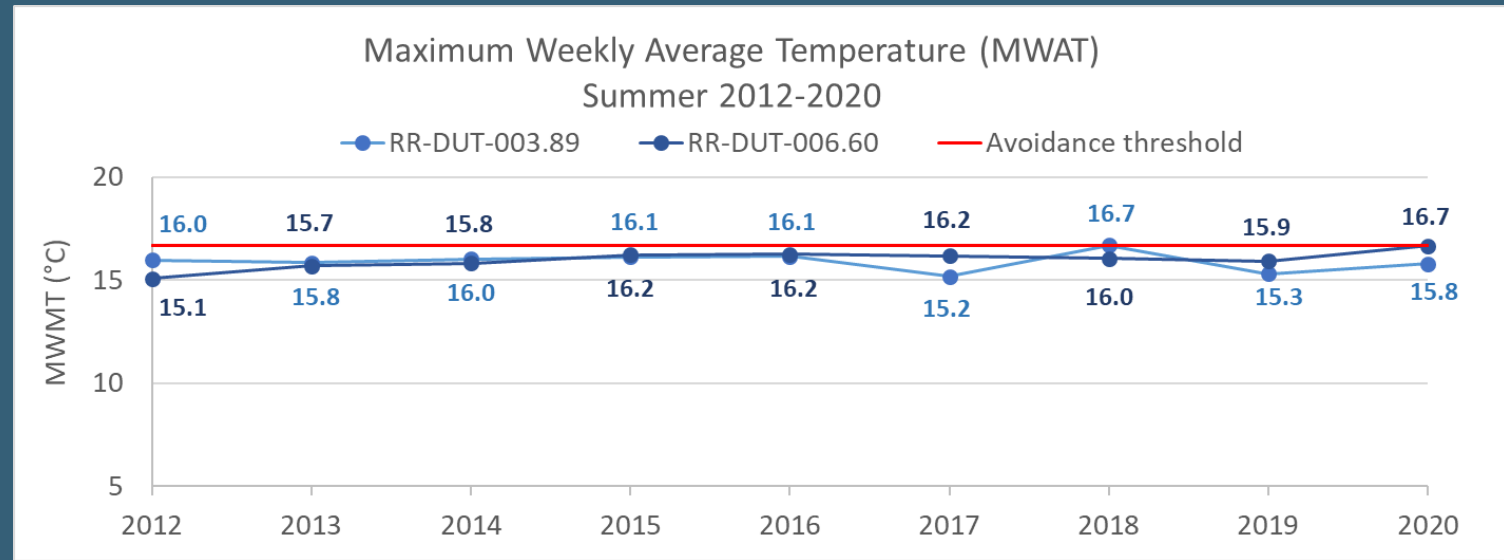


15-minute DO readings in Dutch Bill Creek gauging pools compared to regional objective (NCRWQCB 2015) and mortality threshold (USEPA 1986)

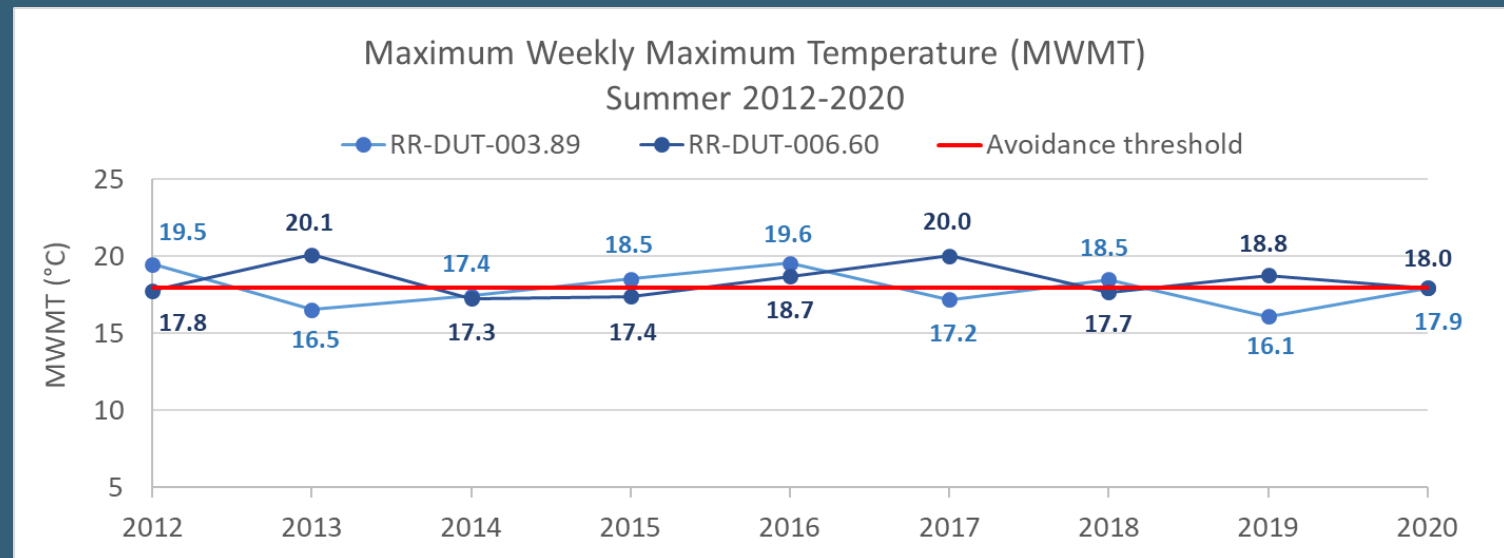
- DO in study pool downstream of Perenne Creek often below salmonid suitability thresholds
- Did not meet regional objective on 38-67% of days, fell below possible mortality limit of 3.0 mg/L for 36% of summer 2017
- However, we saw relatively high survival and growth despite low DO
- DO in study pool at Westminster Woods generally suitable for rearing salmonids
- Met regional objective 85-96% of days, days, fell below 6.0 mg/L up to 12% of a single summer (2017) and under 3.0 mg/L few days

Summer water temperature

- MWATs in both the lower and upper gauging pools within salmonid preference range all sample years
- MWMTs in both gauge pool exceeded salmonid avoidance threshold 4 of 9 years (45%), but at or below 20°C impairment threshold (McMahon 1983)
- *Note on additional water quality - Turbidity: CSG has not collected turbidity data in Dutch Bill Creek, but observed that suspended particulate matter clears very quickly after storms and bed disturbance*



Mean weekly average water temperature at lower and upper Dutch Bill Creek gauging sites from June 15 -October 16, compared to 16.7°C MWAT avoidance threshold (Welsh et al. 2001)



Mean weekly maximum water temperature at lower and upper Dutch Bill Creek gauging sites from June 15 -October 16 compared to 18°C MWMT avoidance threshold (Welsh et al. 2001)

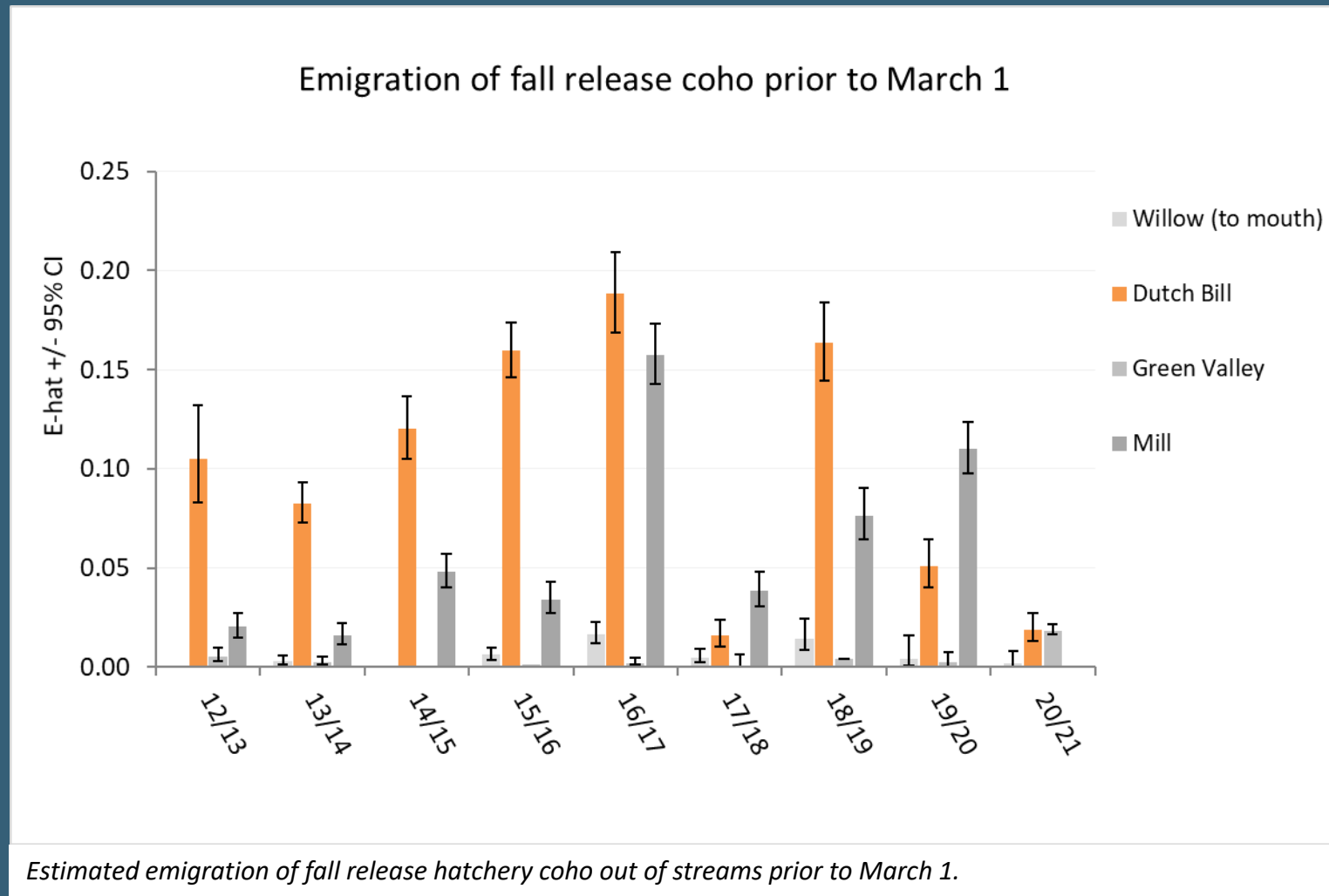
Summer rearing

➔ Attributes: Water Quantity & Water Quality

- ***Key points:**
 - *Rearing occurs throughout the entire stream*
 - *Dutch Bill is heavily and regularly flow-impaired for rearing fish, but has fairly consistent drying patterns and proportions*
 - *Flow release has a notable positive effect on available wetted habitat, stream connectivity and water quality*
 - *Streamflow and oversummer survival in study reaches relatively stable, indicating upper portion of Dutch Bill Creek provides valuable rearing refugia even during drought years*
 - *DO at site pool below Perenne Creek commonly DO-impaired, while upper site at Westminster Woods experienced suitable DO concentrations, above regional objective vast majority of days*
- *Temperatures in Dutch Bill Creek sample pools generally suitable for salmonids, except for during warmest periods*

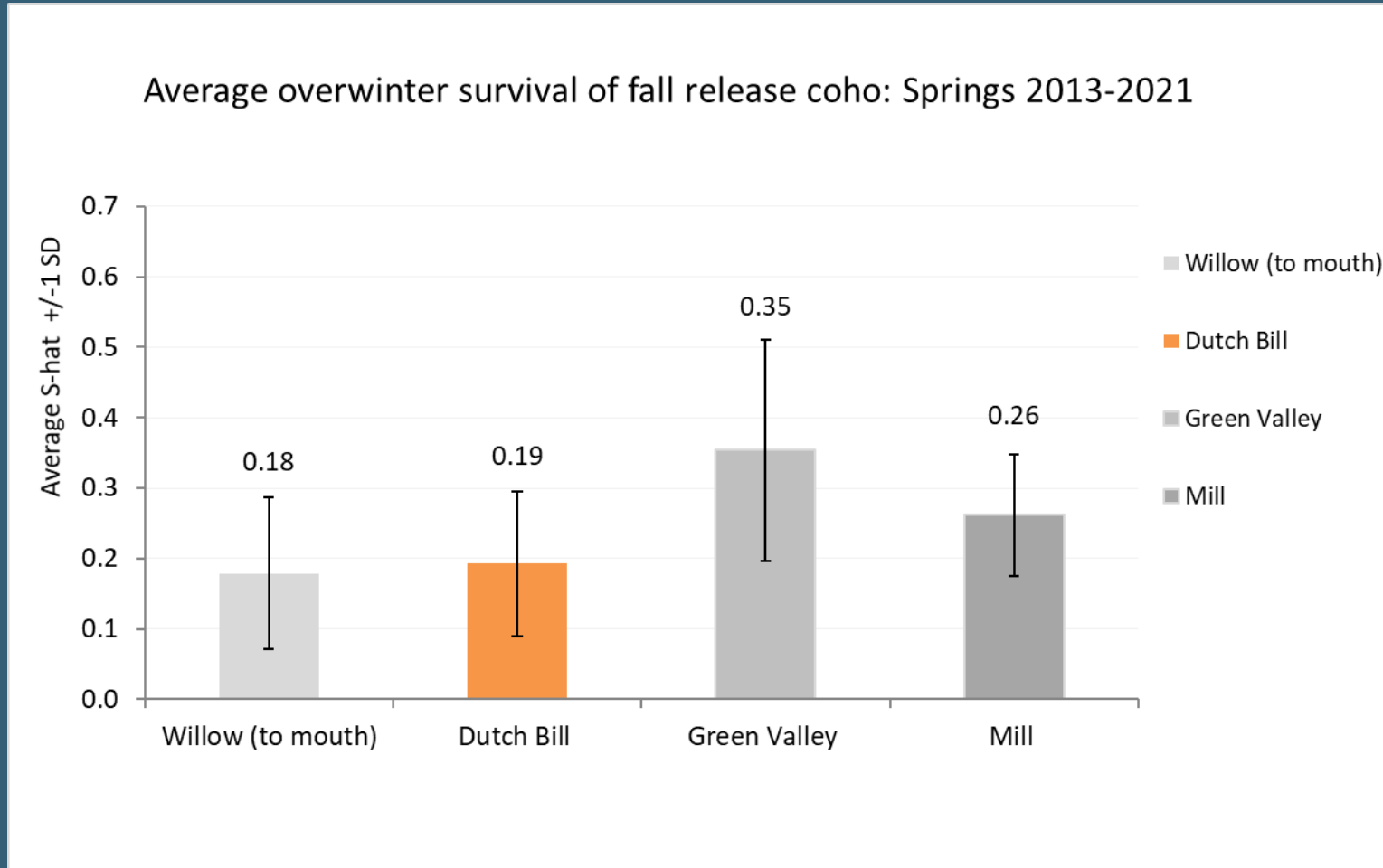


Overwinter rearing



- Dutch Bill has highest proportion of early-emigrating (pre-March 1) juveniles of all LCM streams
- Generally lower early emigration in winters without large storm events, indicating movement is not volitional
- Likely influenced by lack of high-flow refugia (complex structure, off-channel habitat)
- Lower early emigration in 2019/20 and 2020/21 *may* be influenced by instream habitat improvements and/or winter flow conditions, need more data to know

Overwinter survival



- Compared to other LCM streams, Dutch Bill had generally low overwinter survival over past 9 years

Estimated survival of fall release hatchery coho.

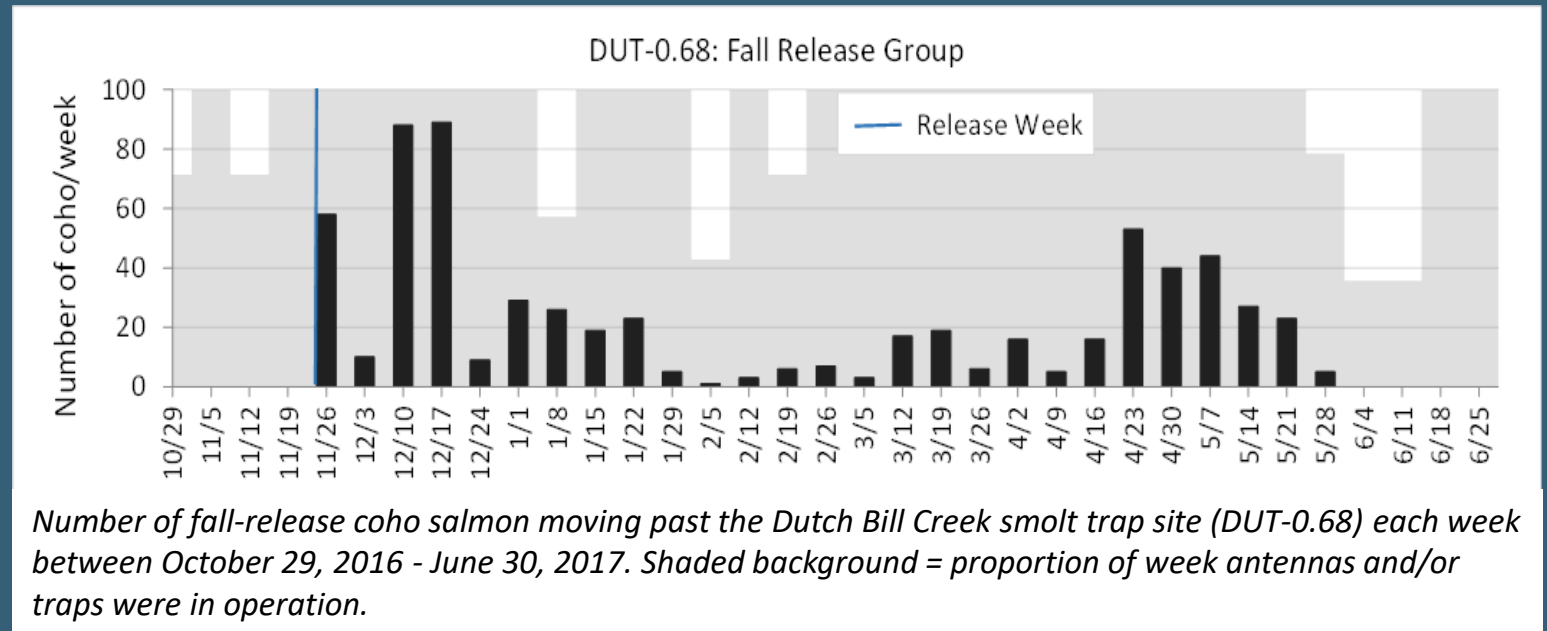
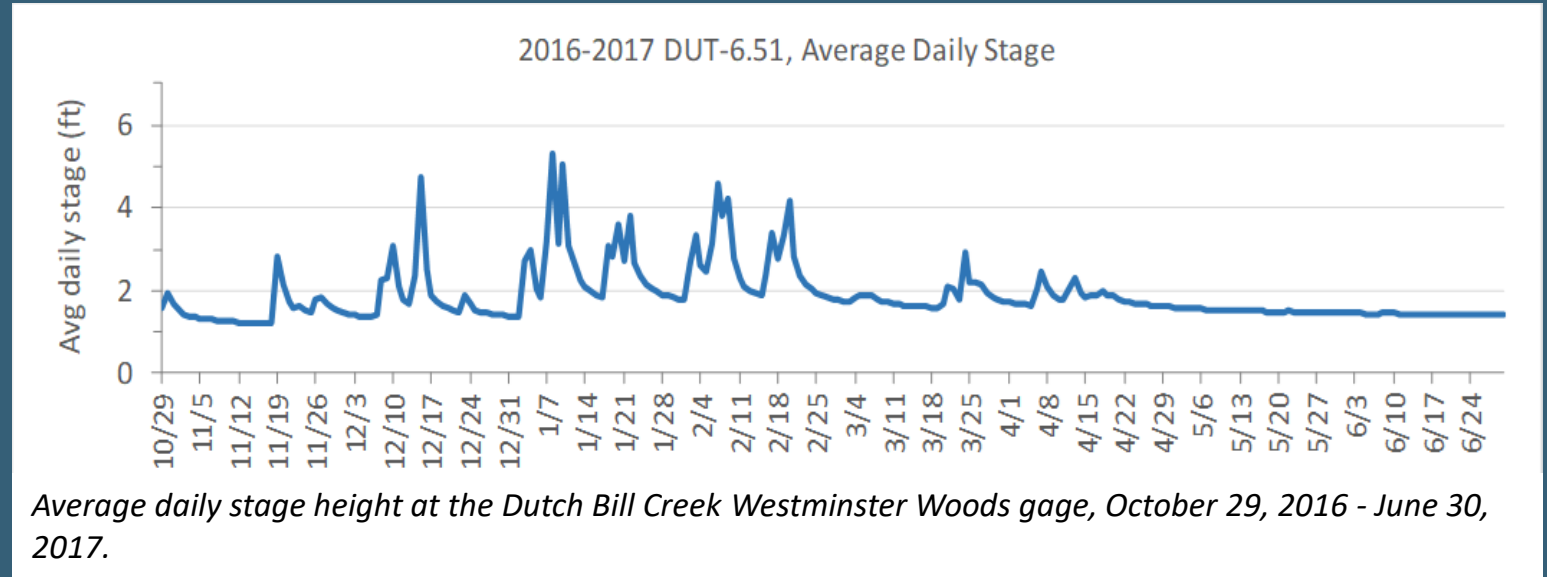
Overwinter rearing



Attributes: Instream Structural Complexity, Off-Channel Habitats

- *Key points:**

- High proportion of winter-rearing fish leave Dutch Bill prior to typical smolt emigration window**
- Generally low overwinter survival**
- Off-channel habitat very limited**
- Instream structural complexity limited, recent structure additions may be improving high-flow refugia**
- Flashiness due to larger, less frequent storm events and alteration of natural drainage patterns appear to play a role**



Water quantity impacts to smolt outmigration



➔ **Attribute: Water Quantity**



- Springs of 2013, 2014, 2015, 2021 and 2022 Dutch Bill Creek became functionally disconnected from Russian River in May, during the smolt outmigration window
- **Key point: Low spring streamflow prevents Dutch Bill Creek smolts from completing their life cycles in some dry years*

Dutch Bill Creek non-native species

 Attribute: Invasive Species

Non-native aquatic species captured in Dutch Bill Creek smolt trap, all years											
Species	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Bluegill	0	0	0	2	0	4	19	1	3	9	0
Bullfrog	1	0	0	0	0	0	0	0	1	0	0
Fathead minnow	0	0	0	0	2	98	2	0	0	0	0
Green sunfish	1	0	0	5	20	8	21	3	4	12	0

Other non-native species observed during snorkel surveys or trapping, but not listed in table include signal crayfish and occasional largemouth bass

**Key point: Non-native species observed in low numbers in Dutch Bill Creek and do not appear to have measurable impact on salmonids*

Dutch Bill Creek - Key observations

- Salmon and steelhead use all of Dutch Bill Creek for spawning and rearing
- Flow impairment impacts fish at all life stages in Dutch Bill Creek
 - Upper Dutch Bill provides much-needed summer rearing refugia, has relatively consistent flow and oversummer survival, especially with the flow releases
 - Summer flow release has had notable benefits in all years
 - Perenne Creek and other left bank tributaries offer important flow contributions
- Recent changes to spawning timing and distribution observed in response to changing climatic conditions
 - Dutch Bill Creek may provide important spawning habitat when adults are unable to access surrounding streams during some dry years
 - In low flow years, fish may be limited to spawning in lower reaches where juveniles are more likely to experience stream drying
 - Increased flashiness of winter flows may negatively impact rearing fish and lead to increased redd drying/stranding

Dutch Bill Creek - Key observations

- Early emigration of overwinter rearing fish relatively high and overwinter survival relatively low in most years
 - Complex instream shelter and access to off-channel habitats generally low and likely contributing to high pre-spring emigration rates and potentially reducing overwinter survival
 - Possible that the recent addition of several woody structures has led to improvements, but we need more data
- Summer water temperatures in monitored pools are generally suitable for salmonids, but on the warm end at hottest periods
- Dissolved oxygen generally meets regional objective in the upper gauging pool, but lower site is often DO impaired
- Invasive species do not appear to have a measurable impact on salmonids in Dutch Bill Creek



Lower Dutch Bill Creek, June 29, 2020