

Durazo Pond Monitoring Report

By: Charles Wickman, Mitzi Wickman, Will Harling, James Peterson



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Background and Introduction

The **Durazo Off Channel Pond (O.C.P.)** is located approximately 1.37 miles up **Seiad Creek** from its confluence with the Klamath River.

This was constructed by MKWC and was completed in November of 2014. Funding for this project came from USFWS and PacifiCorp.

The landowner, Alfonso Durazo, supports this project and has signed a landowner agreement permitting pond construction and follow up monitoring and maintenance for 10 years, with the potential to renew the landowner agreement before it lapses.

MKWC began project planning for the **Durazo OCP** in 2009.

Field reviews with the Karuk Tribe, landowner, Rocco Fiori (Fiori GeoSciences, Inc.), US FWS, CDFW, USFS and others helped to inform data collection needs prior to construction. MKWC performed a topographic survey, installed cross sections throughout the proposed outlet channel and the pond, installed three ground water wells within the perimeter of the off channel feature and took monthly DO and temperature readings from these wells. Based on our analysis, we found that the feature would likely have good dissolved oxygen levels, ideal water temperature for rearing coho salmon, and adequate volumes of water. Prior to construction, all necessary permits were secured, including a 1602 permit from CDFW, 401 certification from the State Water Resources Control Board, NMFS, NEPA documentation from US FWS, and 404 permits from the Army Corps.

Project Objectives

The **Durazo O.C.P.** was constructed to augment limited winter rearing habitat for coho salmon in **Seiad Creek**. Off-channel habitats such as this provide juvenile coho refuge from high stream flows in the winter, and most constructed habitats also provide refugia from potentially lethal Klamath River mainstem water temperatures in the summer and fall. While the **Durazo O.C.P.** was constructed solely for winter rearing habitat, ongoing water quality monitoring and population estimates show that coho also utilize this pond for summer rearing as well.

Construction

The wetted area of the constructed habitat is 8000 square feet during summer base flow conditions. This increases by nearly 1000 square feet during average winter flows. There is an ingress/egress channel at the top pool and the bottom. The egress channel is armored at the downstream side to allow water to backflow into the outlet channel. This also allows the slow water surface area at the entrance of the pond to increase dramatically in high water which increases the likelihood of juvenile coho finding the pond during high flow events (see photo sequence #4). The terminal end of the channel is dry during low flow, summer conditions and approximately 11 feet wide during high flow conditions. **Durazo Pond** has a maximum depth of 10 feet and averages six feet through the center line. The bathymetry is staggered to provide varying depths for cover and forage habitat. Ten wood structures with attached root wads were added to the pond to increase cover for juvenile coho and add complexity to the pond.

Immediately following construction, native grass seed and weed-free straw were spread with a combination of hand work and hydro-seeding with the Karuk Tribe's Watershed Restoration crew to minimize erosion. Since then successive plantings with local schools and other partners have sped up the process of riparian vegetation establishment.



Image 1: MKWC Fisheries Staff installing ground water wells. Wells were used to monitor ground water levels throughout the year prior to construction.

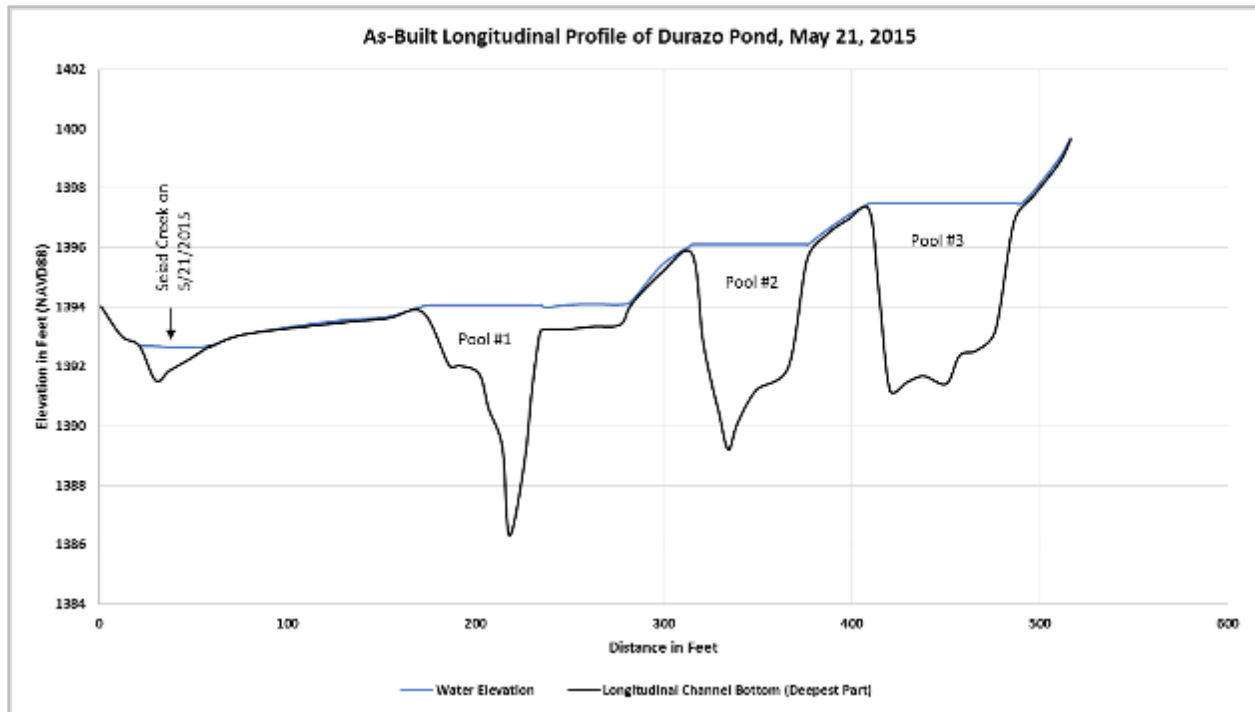


Figure 1: Longitudinal view through Durazo Pond the summer after completion.

Monitoring

MKWC has coordinated with the Karuk Tribe and Humboldt State University to conduct biological and physical monitoring of the Alexander Pond and other constructed habitats from the time they were built to present. MKWC Fisheries staff monitors each off-channel project site twice each month for dissolved oxygen and temperature. In addition, bi-weekly ocular fish counts approximate the number of fish utilizing each site.

A YSI 550A handheld DO/Temp meter is used to collect samples at predetermined locations at each off-channel site, including adjacent tributaries. At **Durazo** Pond, temperature and dissolved oxygen readings are taken at four separate locations with one to three readings at each location to capture effects from stratification. In the winter of 2015, MKWC staff installed an EXO-1 datasonde in the upper pool of the pond to collect temperature, dissolved oxygen and turbidity in this section of the pond. In the lower pool of the pond an Onset U-26 data logger was installed to collect temperature and dissolved oxygen in the lower pool of the pond. Three hobo temperature loggers were also installed in the top, middle, and bottom pools to monitor temperature throughout the year. The Hobo loggers were deployed at the deepest parts of each pool to capture temperatures from the bottom of the pond (6-7 feet). The datasonde and U-26 loggers were deployed at a depth of 3.5ft to capture the temperature and dissolved oxygen levels from the middle water column. Three U-20 water level loggers were deployed in

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the pond, with one logger in each pool. These loggers track changes in surface water elevation by taking readings every half hour throughout the year.



Photo: Water level logger well deployed in pool one of Durazo Pond. Photo was taken in July of 2016 and previous winter's high water mark can be seen on the pipe.

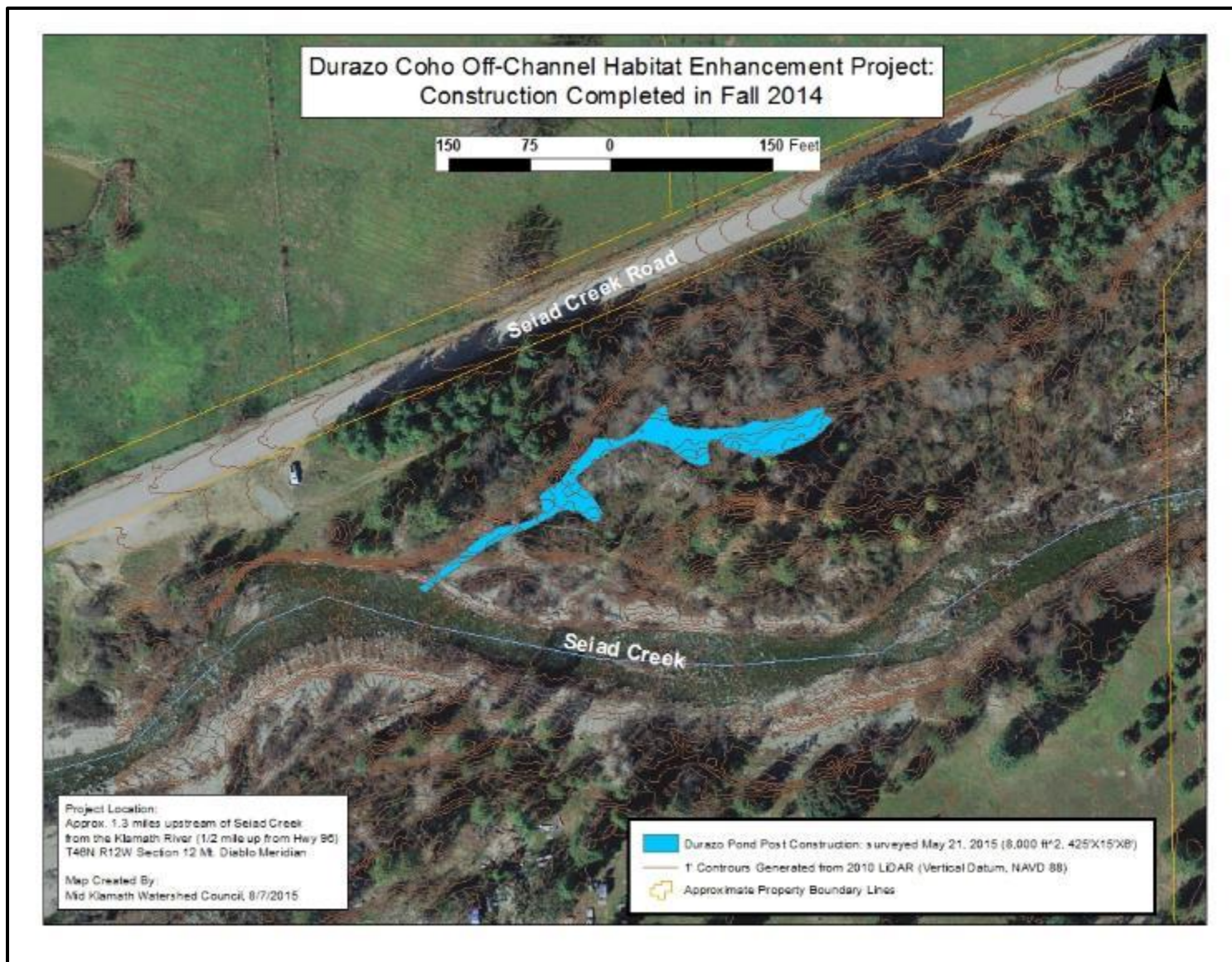


Photo Sequence 1



Photo Sequence 2



Photo Sequence 3



Photo Sequence 4



Photo Sequence 5: Top photos, Happy Camp High School students planting native trees and shrubs around the perimeter of Durazo Pond. Bottom right, Karuk Tribe Biologists Toz Soto and Sophie Price installing PIT tag arrays in Durazo Pond.



Results

Fish Population Estimates

Durazo O.C.P. provides both summer and winter refuge for coho juveniles. Coho have been seen utilizing all three pools of the pond throughout the year since the pond has been built. The Karuk Tribe Fisheries Program (KTFP) installed three stationary pit tag arrays at the outlet of the pond and within the first pool and second pool to monitor fish as they migrate in and out of the pond. Chinook, coho and steelhead have been seen using the pond, and on 2/24/16, MKWC fisheries staff dove the pond and estimated that there were approximately 340, one year old coho rearing within the three pools.

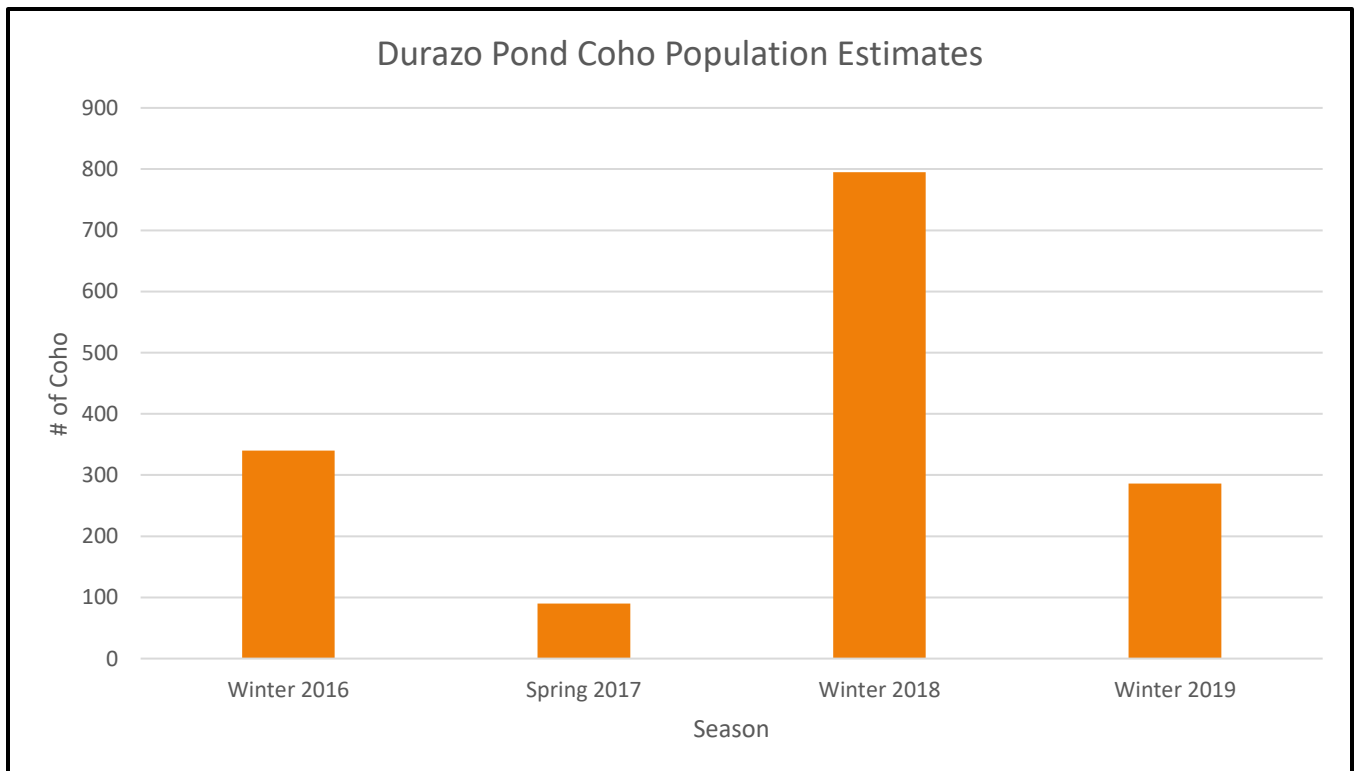


Figure 2: Preliminary Population estimates from KTFP Petersen mar/recapture tagging events. Winter 2016 and spring 2017 coho counts are based off of MKWC staff ocular snorkel counts.

Water Quality Sampling and Dive Counts

Temperature

Durazo Pond is made up of three distinct pools that are connected by two low gradient riffles. This design has shown that each pool has a slightly variable temperature profile from top to bottom. The uppermost pool (Pool #3) has an average winter temperature of 8.6 degrees Celsius and an average summer temperature of 16.9 degrees Celsius. The middle pool (Pool #2) has an average winter temperature of 8.14 degrees Celsius and an average summer temp of 17.21 degrees Celsius. The lowest pool which connects to Seiad Creek (Pool #1) has an average winter temperature of 8.6 degrees Celsius and an average summer temperature of 15.76 degrees Celsius. These averages are based on three years of temperature data for winter 2016-2018 and summer 2015-2017. As the ponds have aged and gone through several seasons of both low and high water, the average summer temperatures have steadily decreased. Temperatures in the pools of the pond stay well within optimal rearing temperatures for juvenile coho salmon. See figures 3-7 for more on temperatures.

Dissolved Oxygen

The following figures summarize the dissolved oxygen sampling results for the **Durazo** Pond. Much like the temperature identities of each pool of the pond, each pool shows its own unique dissolved oxygen profile. By having the pools of the pond tiered and connected by two low gradient riffles, the DO of the pools gradually increases from Pool #3 to Pool #1. Pool #3 has the lowest range of dissolved oxygen readings ranging from .57 mg/L to 6.34 mg/L. Pool #1 had a dissolved oxygen range of 4.46 mg/l to 13.26 mg/L. Overall average DO of the pond is 5.4 mg/L. Like many other slow water constructed habitats, Durazo Pond has more evenly mixed DO levels in all three pools during the winter months and then typically stratifies throughout the summer and early fall months. Average yearly DO for the pond is 5.4 mg/L. Even at lower Do levels juvenile coho were seen throughout the pond. Typically fish spread out to all three pools during the winter and spring and then move down into the lower pool for the summer.

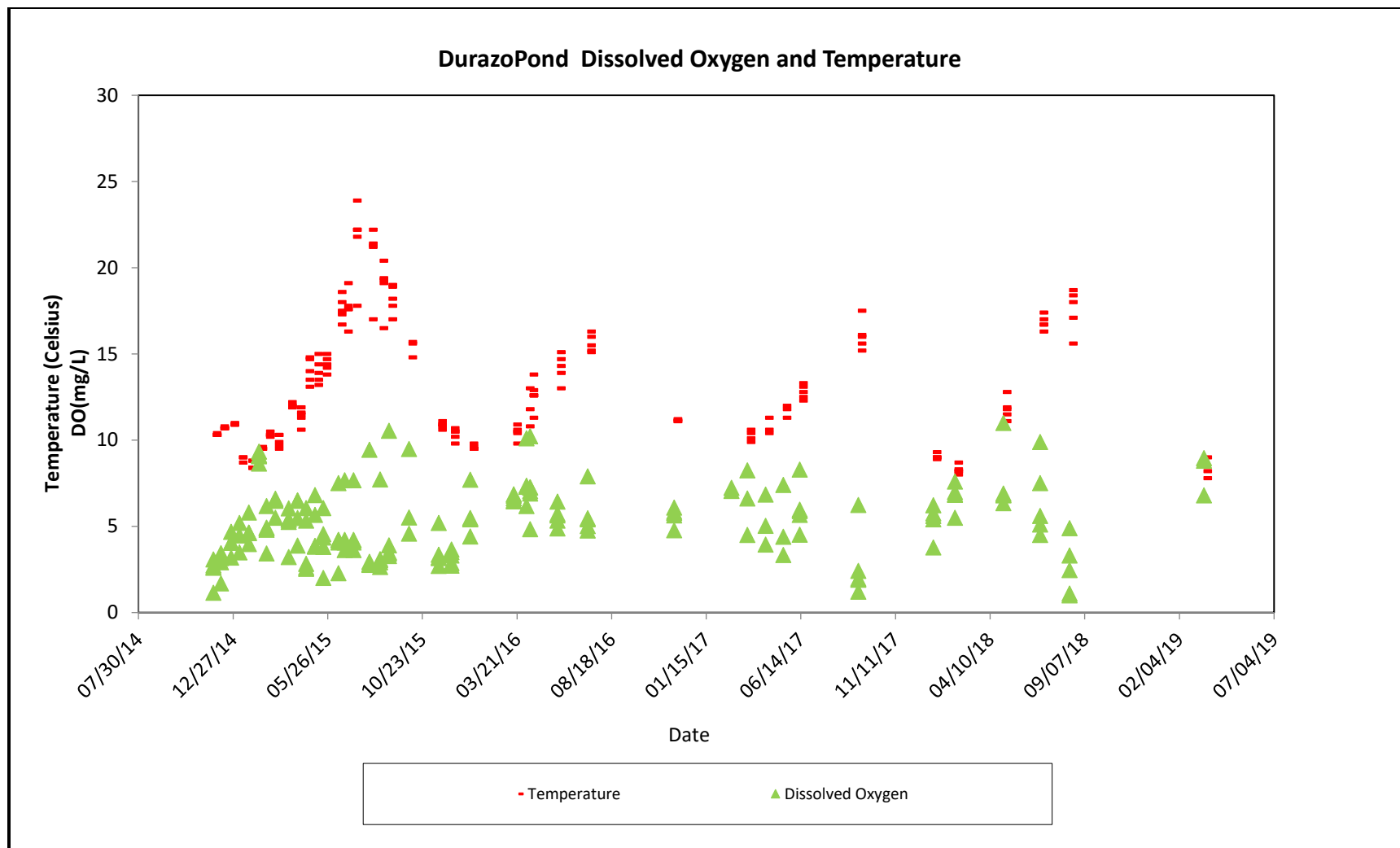


Figure 3: Dissolved oxygen and temperature readings from bi-weekly water quality visits. Readings were taken in each pool at varying depths to capture effects of stratification.

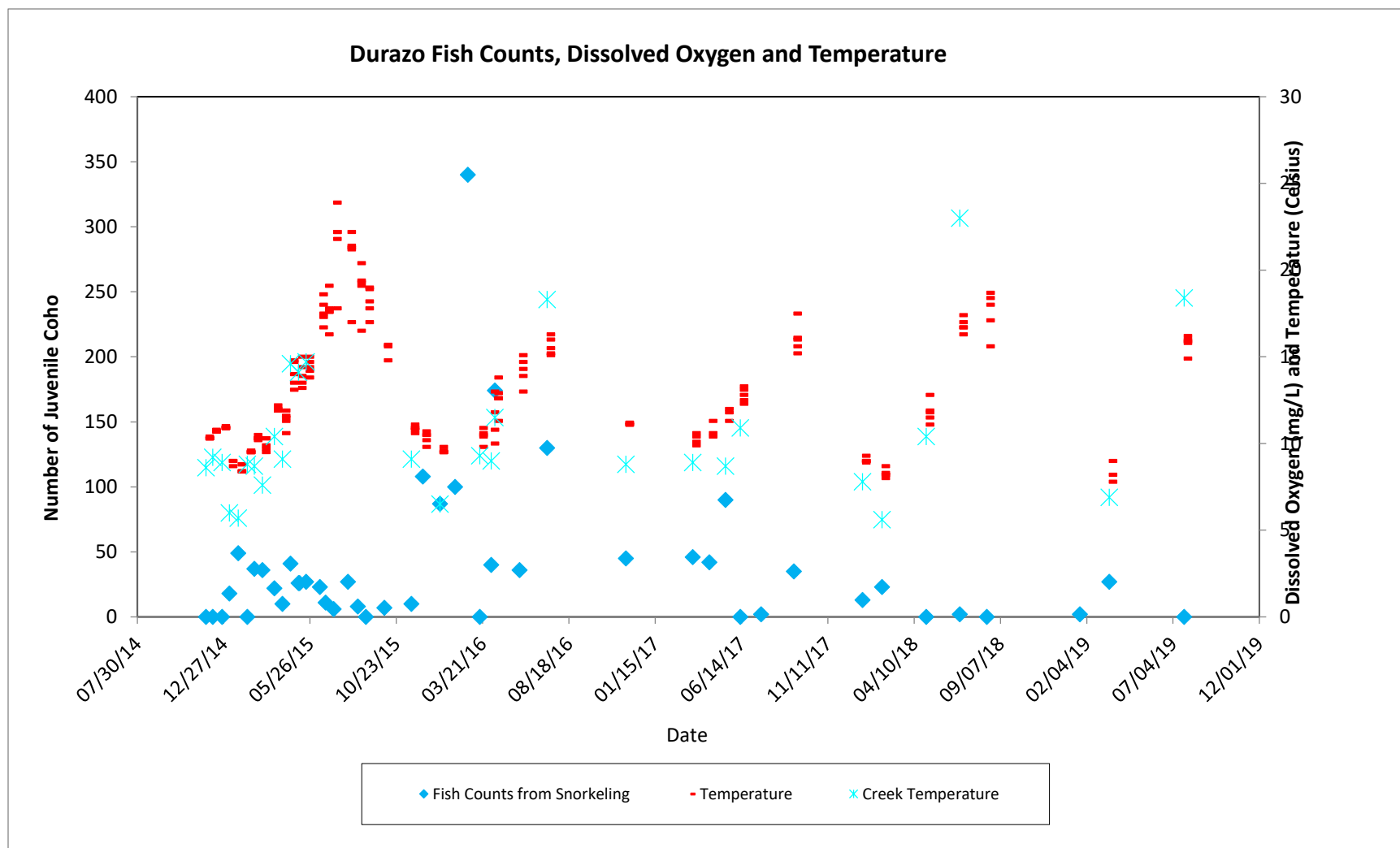


Figure 4: Temperature and ocular fish counts from bi-weekly water quality visits. Low fish count numbers can be attributed to a variety of factors including visibility, connectivity, and complex cover within the pond. For much of 2015, Durazo Pond was not connected to Seiad Creek because of the extreme lack of precipitation during the year. Fish that were able to migrate into the pond were able to rear in good conditions (temperature, DO), instead of becoming stranded in creek as it dried up in early June. In early February 2016, MKWC staff estimated over 300 juvenile coho using the pond, with approximately 100 in each of the three pools. As the pond has aged, ocular counts become more difficult as aquatic vegetation growth creates large areas of cover for fish.

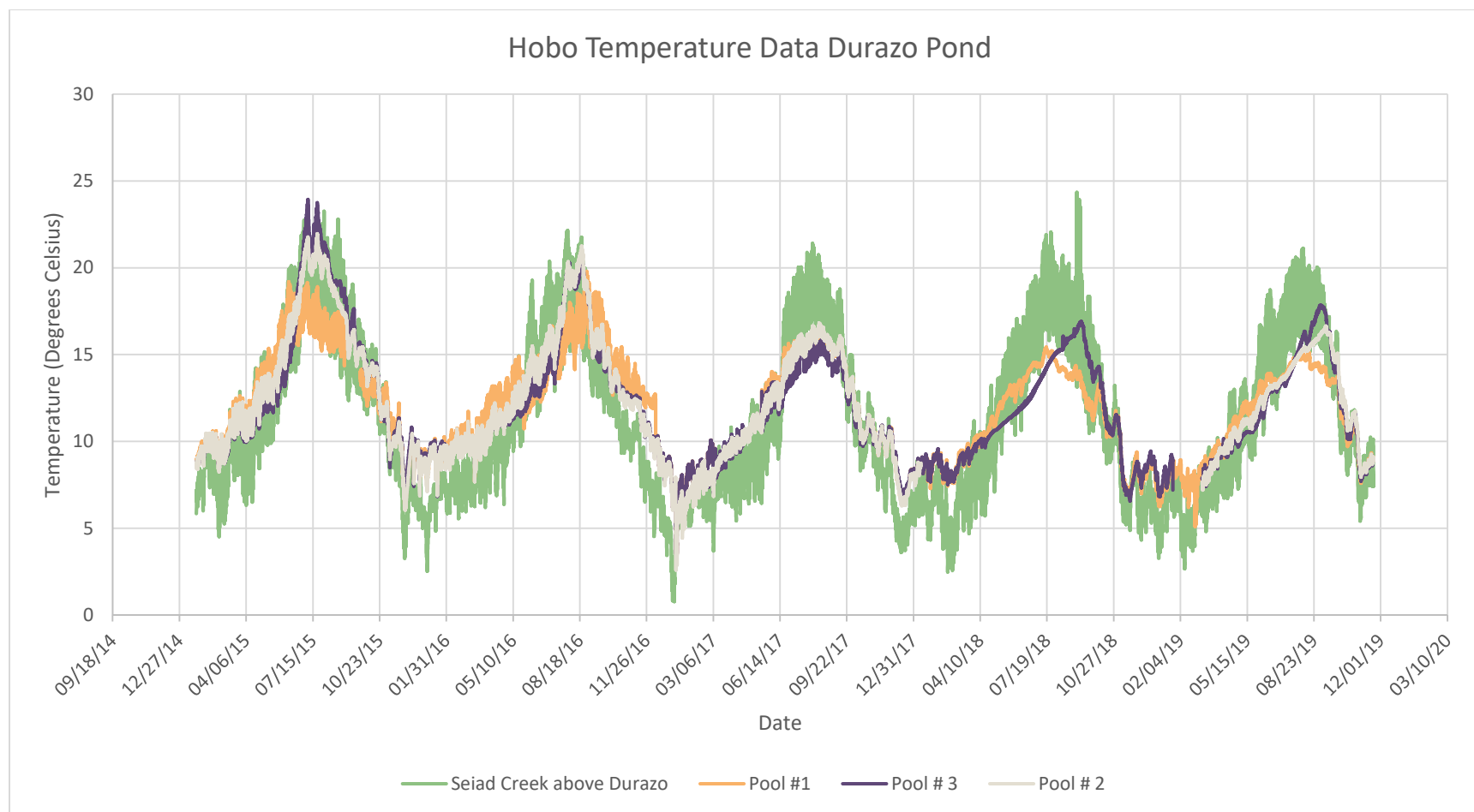


Figure 5: Hobo logger temperature data collected from Durazo Ponds since 2015. One logger was deployed in each pool at an average depth of five feet. The creek logger was placed in the creek ¼ mile upstream from Durazo Pond. Large spike in creek temperature in September 2018 is most likely caused by logger being out of the water.

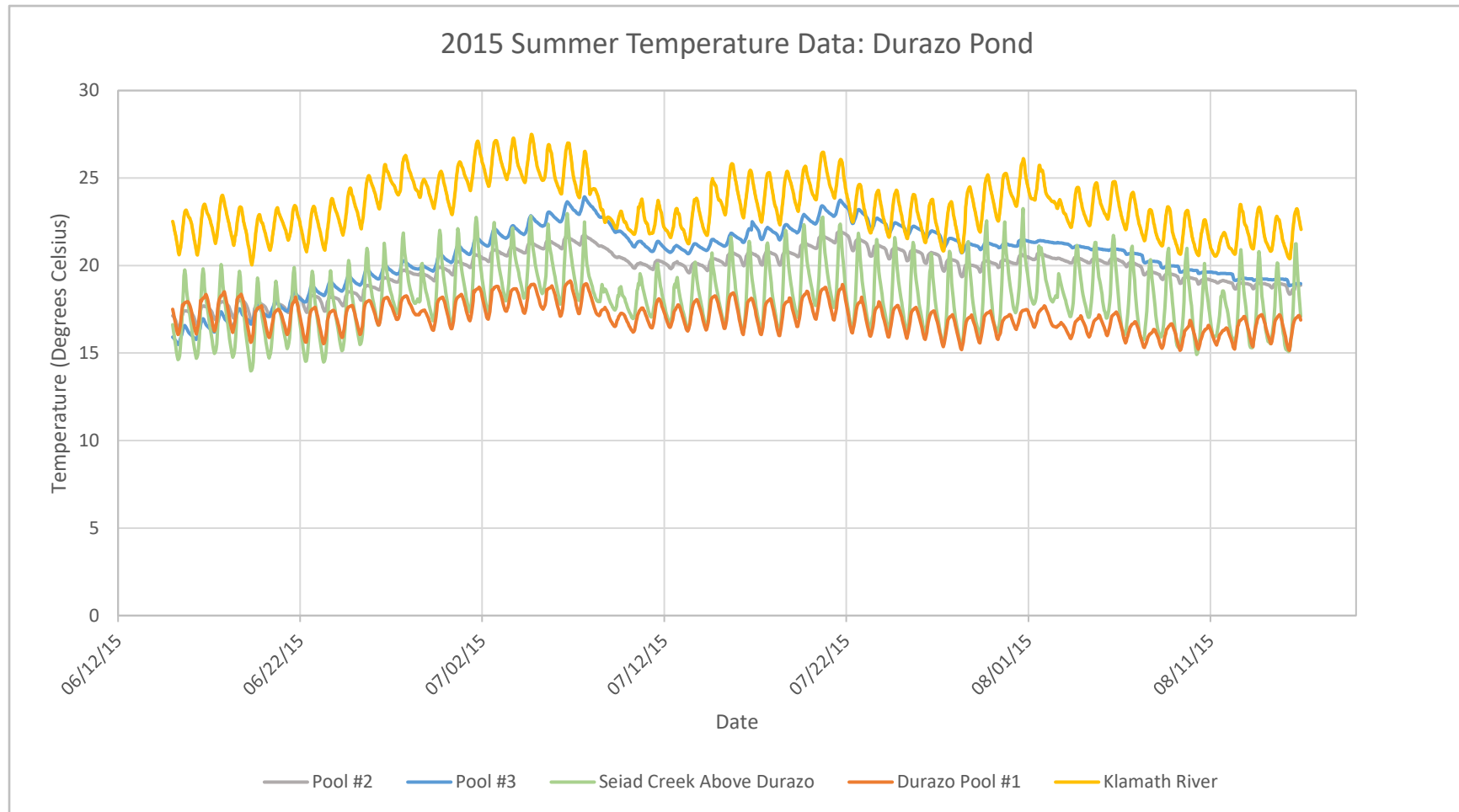


Figure 7: Hobo temperature data from the summer of 2015. The summer of 2015 was exceptionally hot and dry, and was the fifth year of California’s intensive drought. During its first year, Durazo Pond responded extremely well to these intense conditions. The lowest pool stayed within a healthy range for rearing juvenile coho. The upper two pools were disconnected from the lowest pool and no fish were seen in those pools all summer.

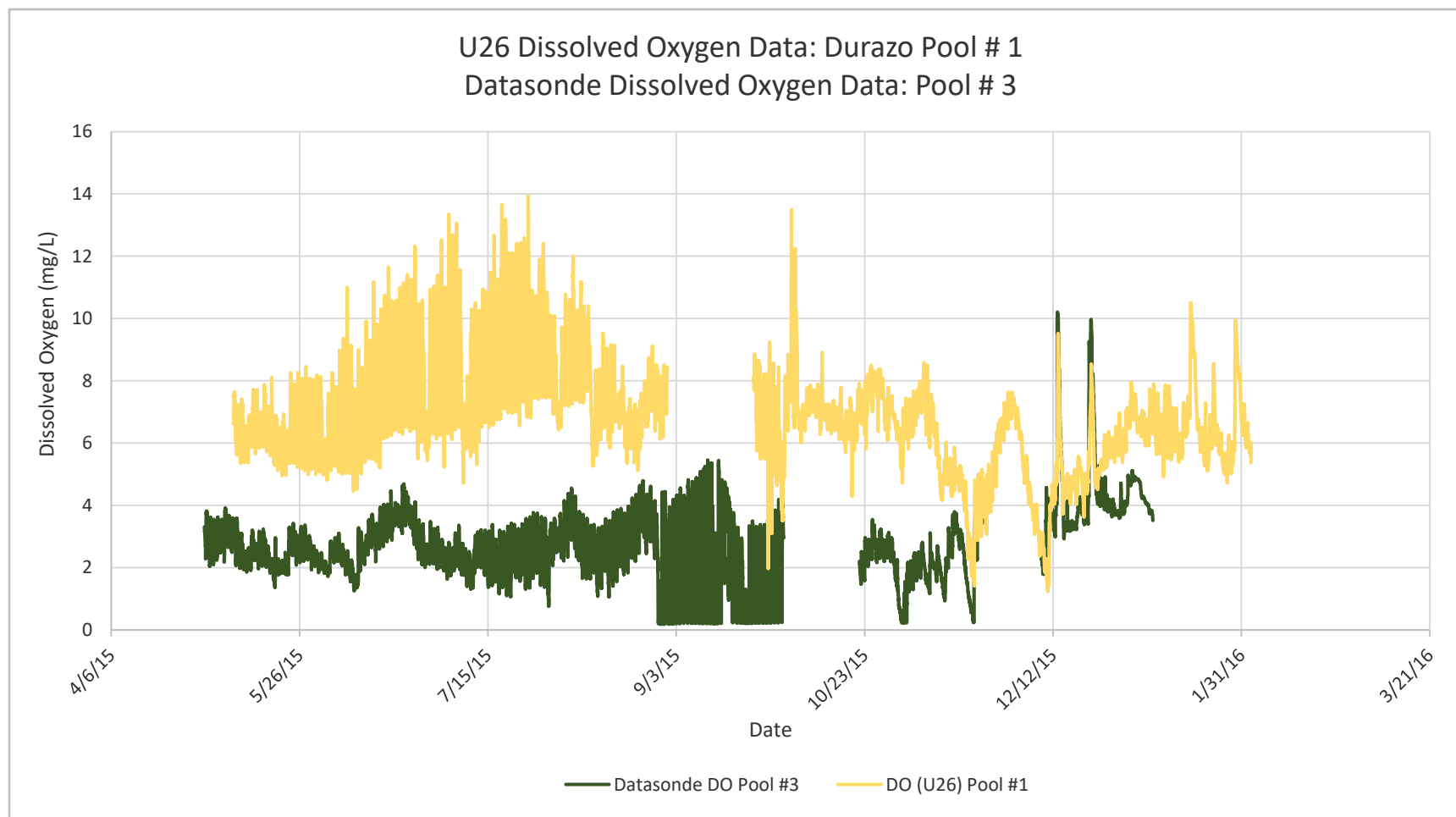


Figure 8: U26 and datasonde dissolved oxygen data from Durazo Pond. The datasonde was deployed in Pool #3 and the U26 was deployed in Pool #1. Each piece of equipment was deployed at a depth of 3.5 feet.

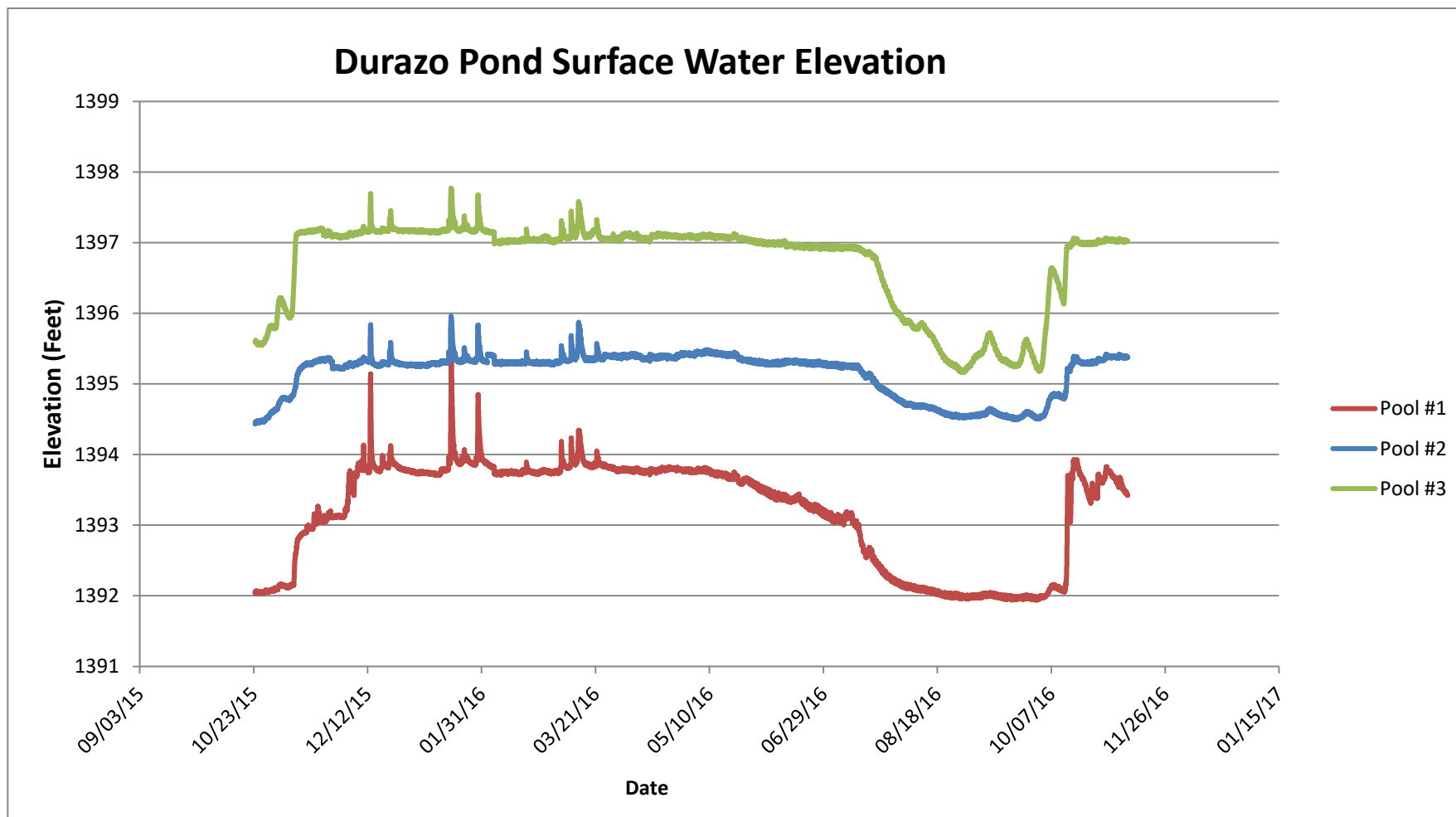


Figure 9: U-20 Onset water level logger data from Durazo Pond. One water level logger was installed in each of the three pools to allow MKWC staff to track water levels in the pond throughout the year.

Juvenile Coho Growth Data

The Karuk Tribe Fisheries Program (KTFP) has conducted quarterly population estimates on the Durazo O.C.P. beginning in the winter of 2016. All data related to growth was collected by KTFP staff during PIT tagging events and is considered preliminary data. Data was analyzed by MKWC senior staff.

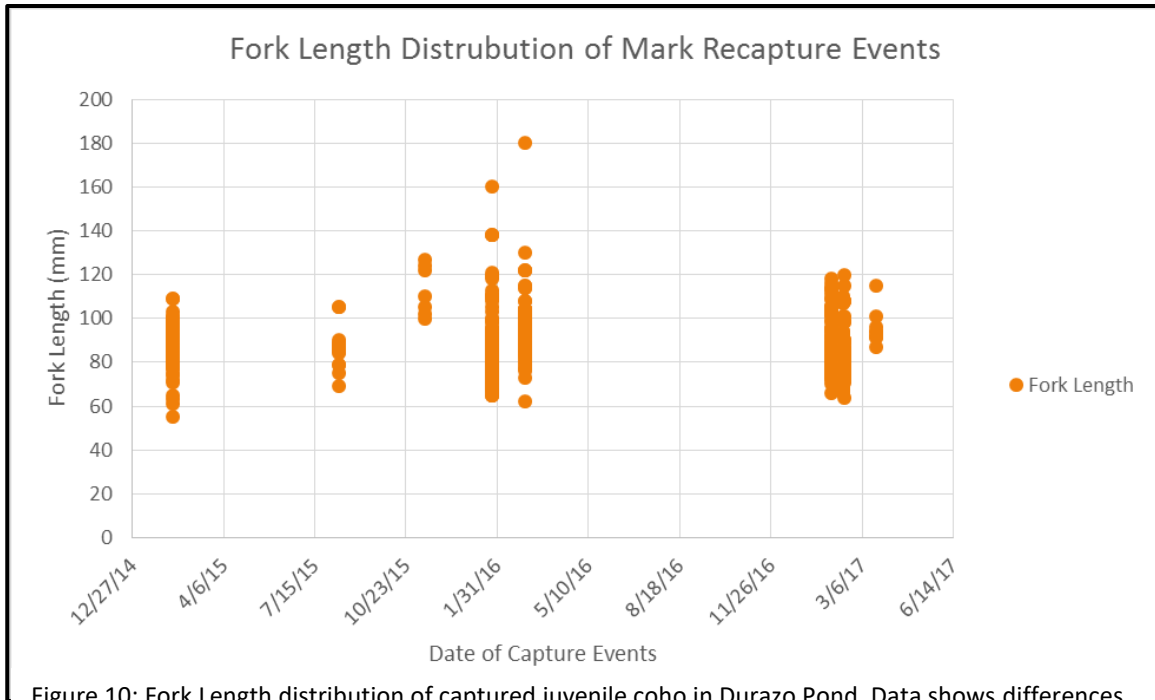


Figure 10: Fork Length distribution of captured juvenile coho in Durazo Pond. Data shows differences in eight capture events over three years. Capture data was collected by KTFP staff during mark recapture events.

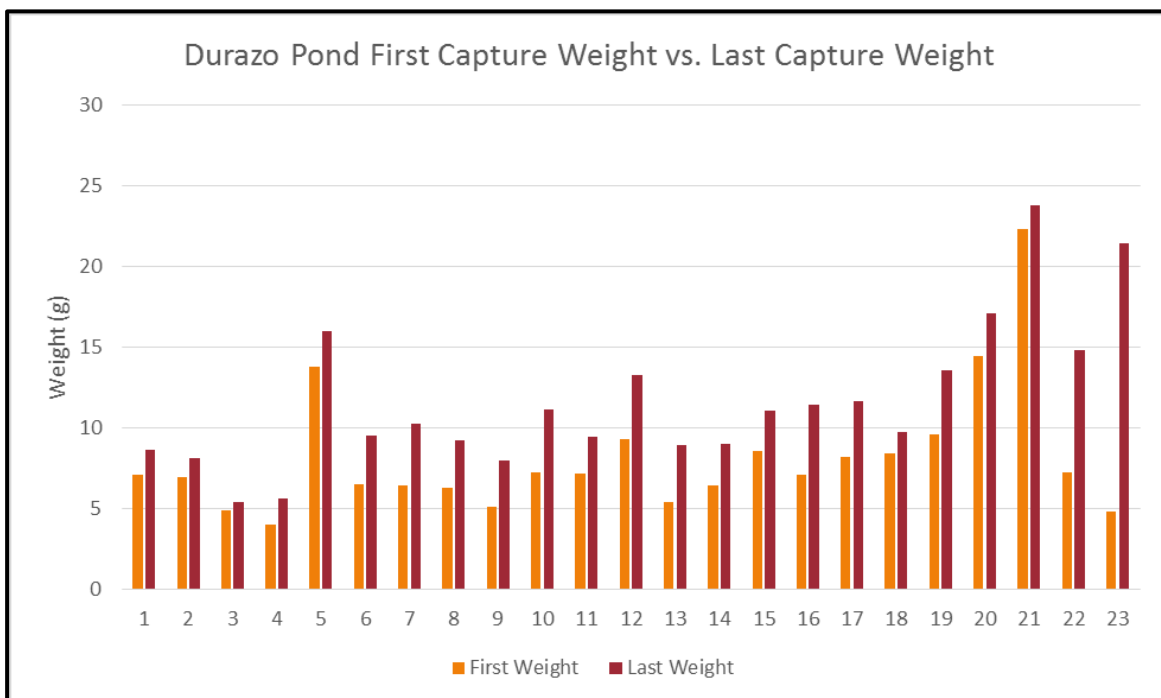


Figure 11: Growth comparison of tagged juvenile coho in Durazo Pond. MKWC staff identified 23 specific coho that had been tagged and recaptured at least once by KTFP staff. Average time between recapture events was 60 days with a minimum of 35 days between captures and a max of 276 between capture events. All recaptured fish showed positive growth over time.

Natal and non-natal coho use: Passive Integrated Transponder (PIT tag) info

MKWC utilized the United States Geological Survey's (USGS) Klamath River Basin Pit Tagging Database to better understand non-natal juvenile coho movement to and from the constructed off-channel habitats. The Karuk Tribe Fisheries Program submits pit tag data to the USGS. During the spring of 2015, MKWC fisheries staff using a handheld Bio-Mark PIT tag reader, detected a year old coho in Durazo Pond that had originally been tagged in Alexander Pond (1.5 miles upstream) during the summer of 2014. This behavior of "leap frogging" from one pond to another has been documented with several of the off-channel habitats constructed along Seiad Creek. Further querying of this Klamath River Basin Pit Tagging Database will further our understanding of coho movement and growth within these systems.

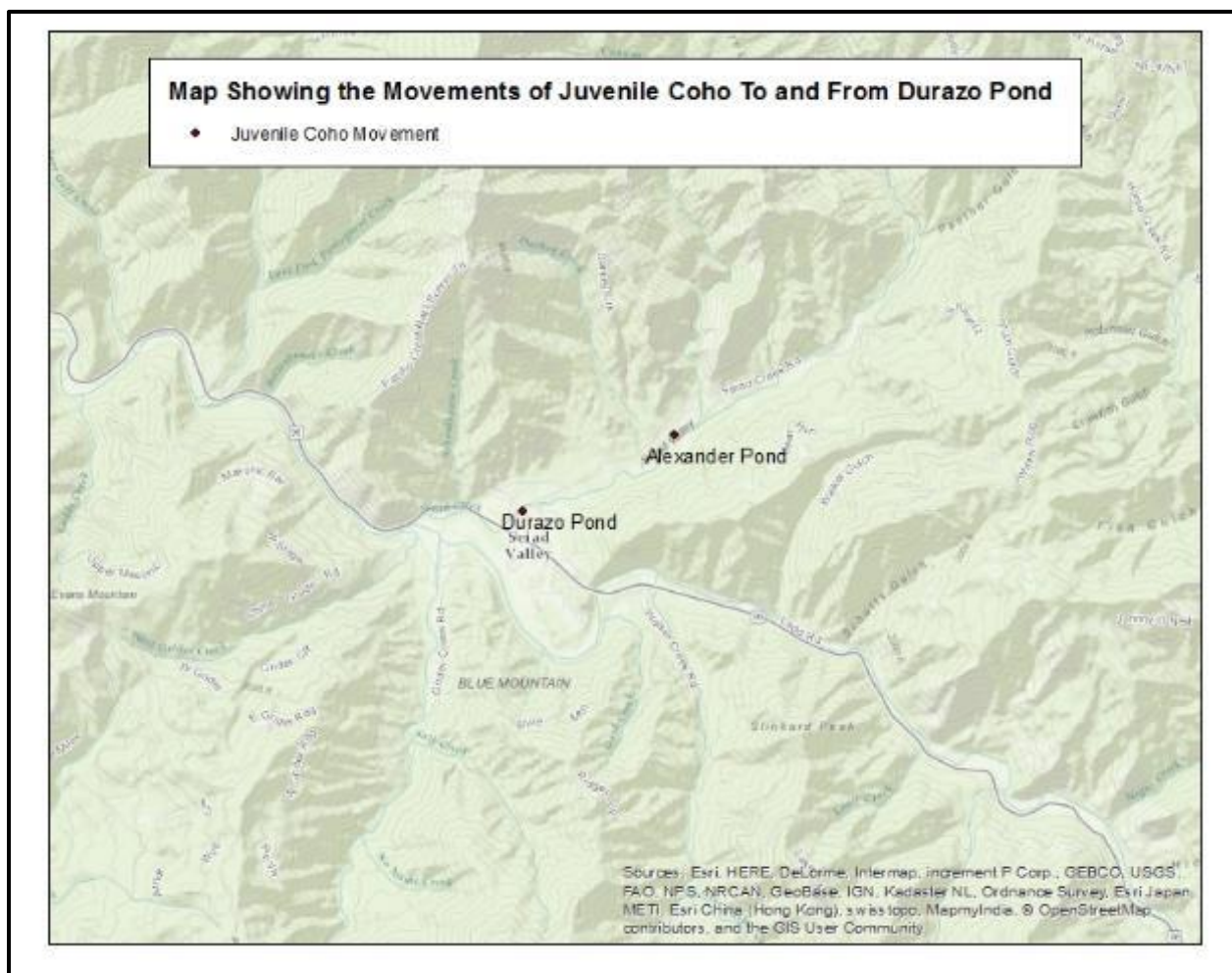


Figure 10: Map showing movement of juvenile coho traveling to and from Durazo Pond

Invertebrate Sampling

No invertebrate sampling has been conducted at the pond site to date.

Connectivity

Durazo Pond becomes seasonally disconnected from Seiad Creek beginning in early June. The creek goes subsurface approximately 1500ft above the pond and 1500ft below the pond site because of extensive instream alterations that have occurred throughout the creeks history, which has created a losing reach in a $\frac{3}{4}$ mile section of creek which Durazo is located along.

Non-native/Invasive presence

In the summer of 2017, MKWC staff began to see bullfrog tadpoles in the pools of the pond. This trend has continued but few if any adult bullfrogs are spotted in the pond. These frogs most likely migrated from a cattle pond a few thousand downstream of the pond. No other invasive fish or amphibian species have been documented to date. Himalayan Blackberry and Poison Hemlock (*Conium maculatum*), non-native invasive plant species that are common throughout Siskiyou County, are present in low densities around the perimeter of the pond but are not plant species of concern.

Lessons learned/Next Steps

Formatting notes

Font box: This entire document is in Calibri (Body) and Calibri (Light), both fonts are included in Microsoft word.

Body copy is 12 point Calibra (body)

Sub heads are 14pt Calibra (body) bolded

Captions are 12 point Calibra (light)

Document title is 28pt Calibra (body) bolded

Paragraph box: Line Spacing Options:

Line spacing is Single

Spacing before and after are set to AUTO

Margins: normal, 1" top and bottom, .75" left and right side

Photos and figures:

Each was ungrouped and the main graphic formatted with a 1pt light grey line.

The caption was formatted to Captions are 11 point Calibra (light, italic), and the graphic and caption regrouped.