Yolo Bypass Project

Telemetry Task (4.3), ERP Grant

2013-14 Annual Report

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Executive Summary

We have completed fieldwork for fall 2013 – spring 2014 of the telemetry task for the Yolo Bypass Project. The table below summarizes the fish we have tagged and monitored from April 2013 – April 2014.

Species	Number Tagged	Date(s) Tagged	Tag Life
Chinook salmon *(Oncorhynchus tshawytscha)*	52	September 26 – November 25, 2013	90 days
White sturgeon *(Acipenser transmontanus)*	25	February 13 – March 11, 2014	10 years

We did not tag juvenile Chinook salmon this year, as water conditions were highly unfavorable.

Detections are available from September 2013 through April 2014. This dataset includes adult Chinook movements within those times; we have one more download remaining (scheduled for late June) to complete the adult white sturgeon (2014) dataset.

With this dataset, we have estimated values for adult Chinook reach-specific residence time, and coarse migration route selection estimates for the 52 adult Chinook salmon. These data are reported in the sections below. Also reported are planned analyses and future explorations before the telemetry portion of the project ends in October 2014.

Note

All calculations and statistics reported here are the results of preliminary, ongoing analyses, and the figures and calculations are subject to change. We will be conducting final statistical analyses of the full Telemetry dataset (March 2012 – May 2014) beginning July 1st, 2014, with expected completion and submission of the Telemetry Final report in October 2014.

Background and Hypothesis

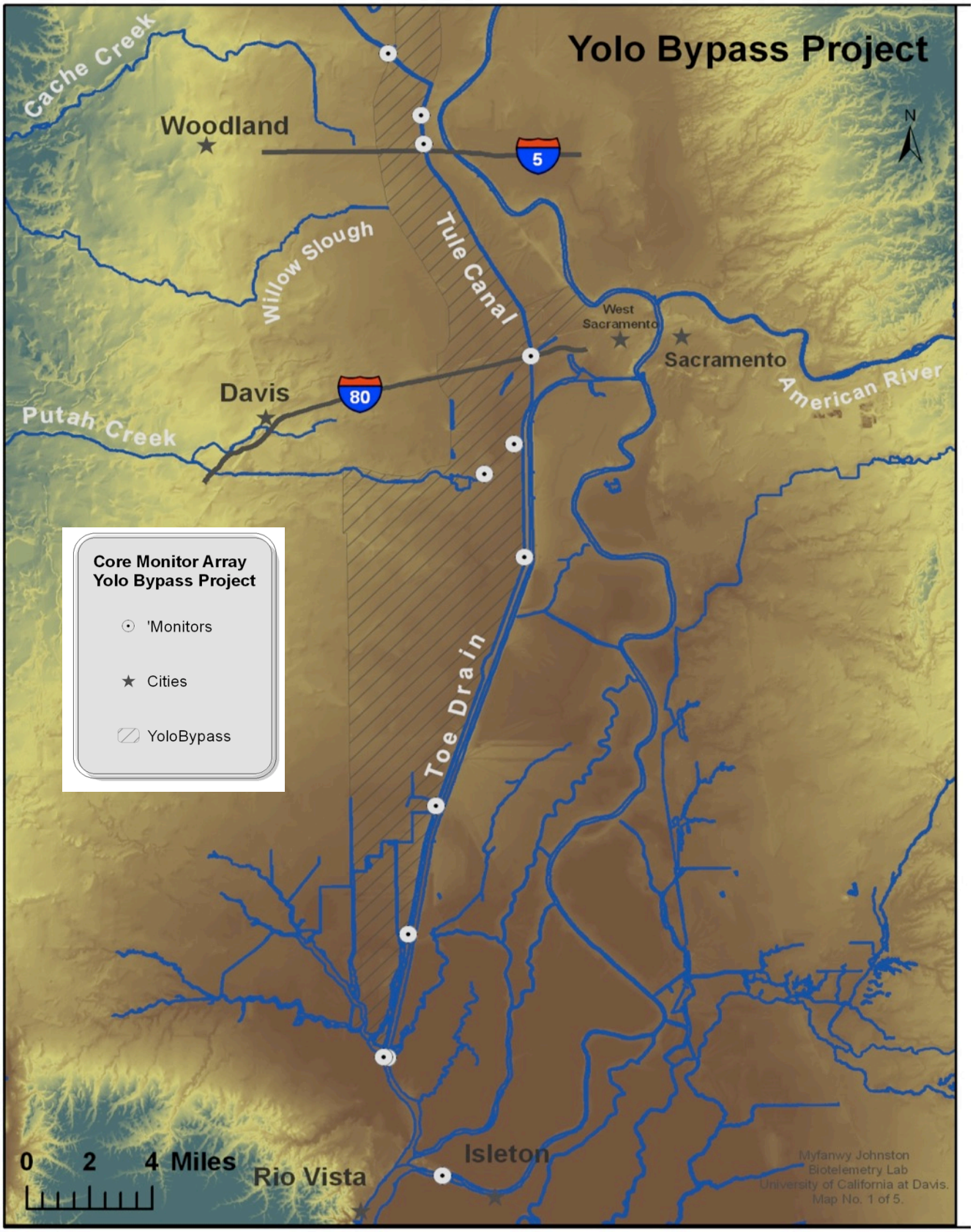
Beyond a general description of the timing and occurrence of large numbers of migrating Chinook salmon, sturgeon, splittail, striped bass (Harrell and Sommer 2003; BDCP 2010), remarkably little is known about what happens to these fishes once they enter Yolo Bypass. As a result, the working hypothesis for the Yolo Bypass Project is broad in nature:

- Residence time and spatial use in the Yolo Bypass of both juvenile and adult migratory species will vary under different hydrological conditions (dry vs. flooded, for example)

To test this hypothesis and identify specific challenges to fish passage in the Bypass, we are asking the following questions:

- What is the residence time of migratory fishes (white sturgeon, Chinook salmon) in Yolo Bypass?
- Where do adult fish move to within the floodplain under different conditions?
- What factors influence juvenile survival in the floodplain?
- Are there specific areas of the floodplain where there is evidence of increased mortality, stress or holding behavior?

We are in the final stages of addressing parts of these questions through the acoustic telemetry task.


Yolo Bypass Project
Cache Creek
Woodland
5
Willow Slough
Tule Canal
West Sacramento
Sacramento
American River
Davis
80
Putah Creek
Core Monitor Array
Yolo Bypass Project
'Monitors
Cities
YoloBypass
Toe Drain
0 2 4 Miles
Rio Vista
Isleton
N
Myfanwy Johnston
Biotelemetry Lab
University of California at Davis.
Map No. 1 of 5.

DATA SUMMARY

Acoustic Receiver Arrays

We maintain two separate arrays of Vemco VR2W receivers in the Yolo Bypass: 69khz and 180khz. The number of deployed receivers depends on the conditions present in the Bypass (flooded or dry). The map on the previous page depicts our core array of receivers (both 69khz and 180khz) under dry conditions. Under flood conditions, more receivers are placed in the Bypass across I-80 and at the confluence of the deep water shipping channel and the Toe Drain.

Tagging Summaries

Adult white sturgeon (25 Fish, Tagged 2/13/14 – 3/11/14)

Fork Length Range (cm)	Mean Fork Length (cm)	Known Males	Known Females	Sex Unknown
109-208	155	23	1	1

Adult Chinook salmon (52 Fish, Tagged 9/25/13 – 11/26/13)

Fork Length Range (cm)	Mean Fork Length (cm)	Known Males	Known Females	Sex Unknown
60 – 99.8	81	23	24	5

White sturgeon were implanted with Vemco V16 tags, and adult Chinook salmon were externally tagged with Vemco V9 tags. All tagging procedures went very smoothly.

Adult White Sturgeon Telemetry Summary

We have one more set of downloads remaining for the final detections of the white sturgeon tagged this year, and as such have not begun to analyze them yet. Analysis will begin July 1st, 2014.

Adult Chinook Telemetry Summary

The table below summarizes the receiver sites for the Yolo Bypass. For each location, the river kilometer, number of fish detected, total number of detections, and rough detection probability is displayed.

Site	River Kilometer	Fish Detected	Total Detections	Detection Probability (estimated)
Confluence	0	43	7367	0.89
Base of Toe Drain	7.21	43	3876	1.00
Rotary Screw Trap	14.44	42	9937	1.00
Lisbon Weir	29	20	14500	0.90
Above Lisbon	30.5	11	2122	0.86
I-80 Bridge	39.84	9	2196	1.00
Cache Creek	52.83	1	39	1.00
Knagg's Ranch	54.59	1	116	1.00
Wallace Weir	59.14	0	0	N/A

Adult Chinook Telemetry Summary

As it was evident early on that there were a large number of fish in the system (and as our capture rates had improved significantly), we requested and received permission to tag 25 additional fish (we were originally permitted to tag 38 adult Chinook in 2013). With this increased sample size, we hope to be able to examine route and migration timing in more depth, and provide information to managers addressing the Chinook stranding issue in the Colusa Drain (Vincik & Johnson, 2013).

Fifty-two adult migrating Chinook salmon were caught and tagged in the Toe Drain: thirty-seven at the lower reach of the monitor array, just below the Rotary Screw Trap (river km 165), and fifteen lower down in the Toe Drain at Lisbon Weir and the Fyke Net (river km 14.44).

Adult Chinook Residence Time Summary

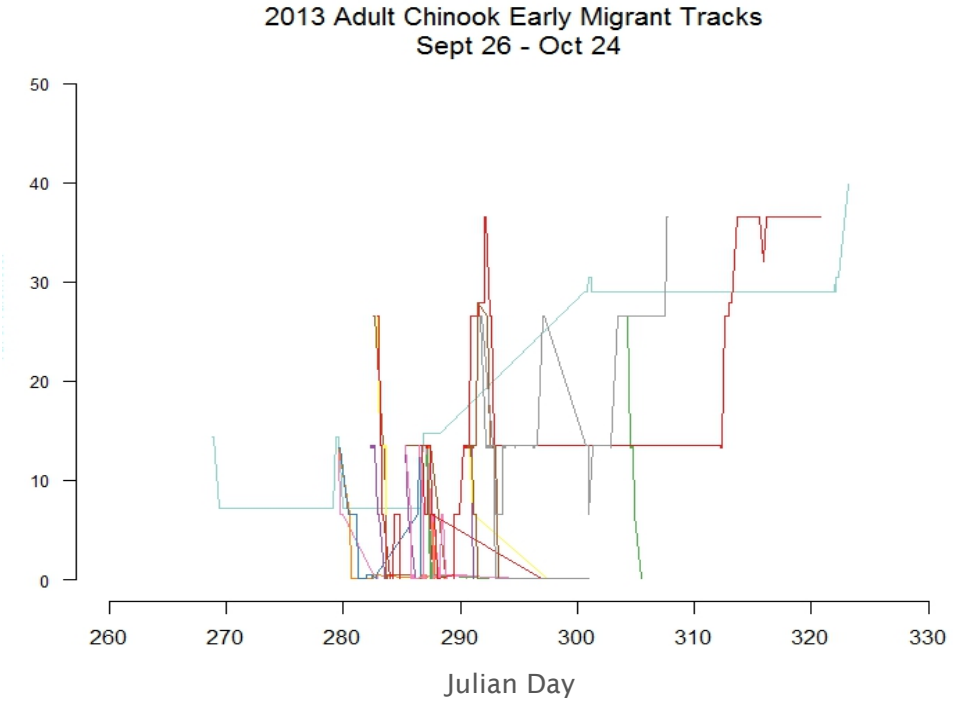
Site	River Kilometer	Number of Fish	Mean Residence (days)
Confluence	0	43	0.34
Base of Toe Drain	7.21	43	0.28
Rotary Screw Trap	14.44	42	0.51
Lisbon Weir	29	19*	0.67
Above Lisbon	30.5	11	0.52
I-80 Bridge	39.84	9	0.30
Cache Creek	52.83	1	0.03
Knagg's Ranch	54.59	1	1.61

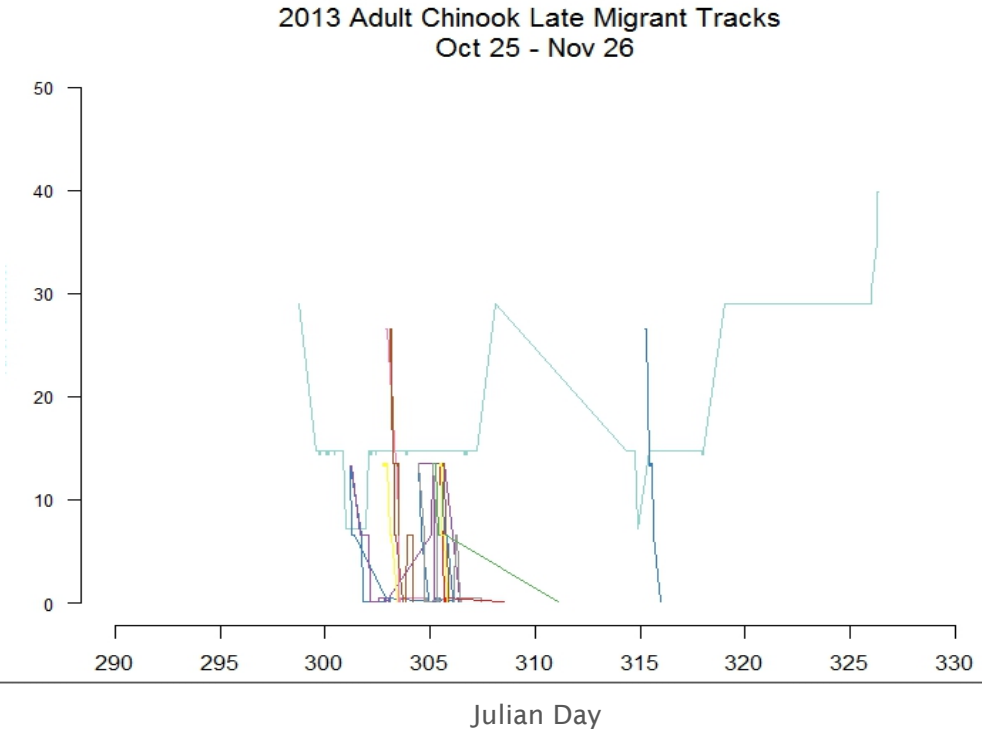
*outlier removed

Through a collaboration with the Biotelemetry Lab of UC Davis, we were also able to observe some of their subsequent movements in the Sacramento River and San Joaquin Rivers. As of May 1st, 2014, 11 individuals were last detected in the Sacramento Delta (below Freeport and above the Richmond Bridge), 2 individuals were last detected in the San Francisco Bay, 9 individuals were last detected in the Sacramento River, 10 individuals were last detected in the American River, 4 individuals were last detected in the San Joaquin River, and 3 individuals were last detected in the Mokelumne River.

Adult Chinook Movement Summary

We will be analyzing these data in a number of ways this summer (July – September, 2014). Below are some preliminary graphical representations of the telemetry data gathered in 2013. The graphs summarize movement tracks when the sample is split between "early" migrants (individuals tagged between September 26th and October 24th) and "late" migrants (individuals tagged between October 25th and November 26th). While we haven't run statistical analyses yet, the graphs suggest possible differences between the two groups, and we will be examining this further.





Conclusions

It is difficult to draw any conclusions at this early stage of the analysis. It is clear that our target species demonstrate high individual variability in their movements. We have demonstrated the efficacy of telemetry in the Yolo Bypass, and look forward to beginning analysis on the full data set beginning on July 1st, 2014.

Recommendations and Future Analyses

The first two years of our study has seen very dry conditions in the Bypass. This has helped our detection probabilities, but has hindered our ability to compare fish movement and residency behavior under different environmental conditions. We are still hoping to observe juvenile and adult movement behavior in the Bypass under flooded conditions.

As we had hoped, we had much greater success with capturing adult migrating Chinook salmon this year, and thus the sample size was over three times what it was in 2012. A statistical power analysis will show whether the two years should be grouped as one sample (as conditions were similar, but sample size was very different, this is a possibility). Additionally, we will be examining detection histories of our fish from the 300 receivers maintained in the area surrounding the Yolo Bypass by the California Fish Tracking Consortium. This will allow us to complete individual fish tracks with all available detections, and to examine mortality in the system, especially for the adult Chinook.

Future explorations and analyses will include:

- Movements relative to environmental conditions – in particular, pulse-flow events and tidal stages.
- Detailed acoustic monitor range tests.
- Movement behavior around spatial and environmental barriers (weirs, dams, temperature thresholds).
- Tag-survival probability
- Habitat characterization of the Toe Drain and the areas of the Yolo Bypass that become inundated during flood events.
- Group movements – arrivals and departures at monitors in groups
- Mortality assessment – identifying areas of increased holding or stranding.

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