Stillwater Sciences

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MEMORANDUM

DATE: December 21, 2006

TO: Karen Rippey
US Army Corps of Engineers
and
Napa WICC Technical Advisory Committee

FROM: AJ Keith and Russ Liebig

SUBJECT: Progress Report for work completed from August 2006 through December 2006 for the Napa Steelhead Bioenergetics study (Task 10).

Subtask 1050 – Temperature QC / Analysis:

In July 2005, temperature monitors and water level recorders were installed in each of the 12 study reaches. These recorded water temperature every hour over the length of the project and were removed in August 2006.

Temperature monitoring occurred at 12 reaches in five streams:

1. Upper Ritchey Creek
2. Mid Ritchey Creek
3. Lower Ritchey Creek
4. Upper York Creek
5. Lower York Creek
6. Upper Heath Canyon
7. Mid Heath Canyon
8. Lower Heath Canyon
9. Upper Pickle Creek
10. Lower Pickle Creek
11. Upper Redwood Creek
12. Lower Redwood Creek

The Napa River watershed received high levels of rainfall during December 2005 and January 2006 which produced flood-level flows that altered stream channels in our study reaches. In some study streams there were large sediment deposits filling pools and run habitats, whereas in others the channel was newly scoured down to bedrock. As a result, several temperature loggers were destroyed or washed downstream. These loggers were replaced in the Spring of 2006.

During each of the fish monitoring events, these loggers were downloaded and the data were compiled into one continuous dataset. The stream temperature analysis included plotting the maximum, minimum, and average temperatures at each monitoring site and included an analysis of stream temperature at each site. Figure 1 shows an example of the stream temperature data plotted for one example location: the upper reach of Redwood Creek.

Subtask 1051 – Flow QC / Analysis:

In July 2005, water level recorders were installed in each of the 12 study reaches. These recorded flow conditions every hour for the duration of the steelhead growth monitoring period. The level loggers were removed in August 2006.

Two types of water level loggers were installed: pressure transducers and capacitance transducers. The capacitance transducers (shown in the photo) were donated by the San Francisco Regional Water Quality Control Board. The additional level loggers allowed us to place recorders in all 12 reaches. Flow was measured at each logger location during setup and at each steelhead sampling event. However, as a result of the 2005/2006 flood flows, over half of the level loggers were destroyed or washed downstream. The remaining loggers were redeployed in order to ensure at least one functional logger was installed in each study stream.

In addition to the water level monitoring by the level loggers, stream discharge was also measured during each of the fish monitoring events to calibrate the level logger and to allow for the creation of a stage discharge relationship. During each of these monitoring events, data from each of the level loggers was downloaded and compiled into one continuous dataset.

The analysis of discharge data included the calculation of the base flow during each sampling event. This was then combined with stream parameters (such as width) to calculate a flow index for each stream in order to normalize flow descriptions for comparative purposes. The flow indices for each of the 5 study streams are included in Table 1.

Subtask 1061 – Bioenergetic modeling:

Analysis of steelhead recapture data and growth modeling has been completed. The data indicate very low growth in streams of all flow and channel types during the summer/fall (Figure 2) and winter periods (Figure 3). Negative growth (i.e., weight loss) was observed in streams of all flow and channel types during the period from August–October 2005 (Figure 2). Growth was highest in spring (February–May 2006), and no negative growth was observed during this period (Figure 4). These results indicate that spring is the most important growth period for juvenile steelhead in Napa River tributaries, regardless of flow regime or channel type.

Growth of individual fish was analyzed by cohort (year class) for each study site. A summary for all sites is shown in Figure 5. Statistical comparison indicates no significant differences in growth between cohorts during any of the three seasonal growth periods (Figure 6).

Next Steps:

Report preparation is underway. Report preparation will include synthesis or results from each study component and discussion of the influence of water temperature, stream flow, channel type, and food supply on steelhead growth. As agreed by USACE, Stillwater Sciences, and Napa County (Jeff Sharp), Stillwater will prepare the Draft Steelhead Growth and Bioenergetics Report and submit it to USACE and the Napa County WICC TAC by March 1, 2007. Stillwater will attend the TAC meeting scheduled for March 8, 2007 to discuss the draft report, including comments from the TAC members. After receiving comments, Stillwater will revise the draft report and produce the final report.

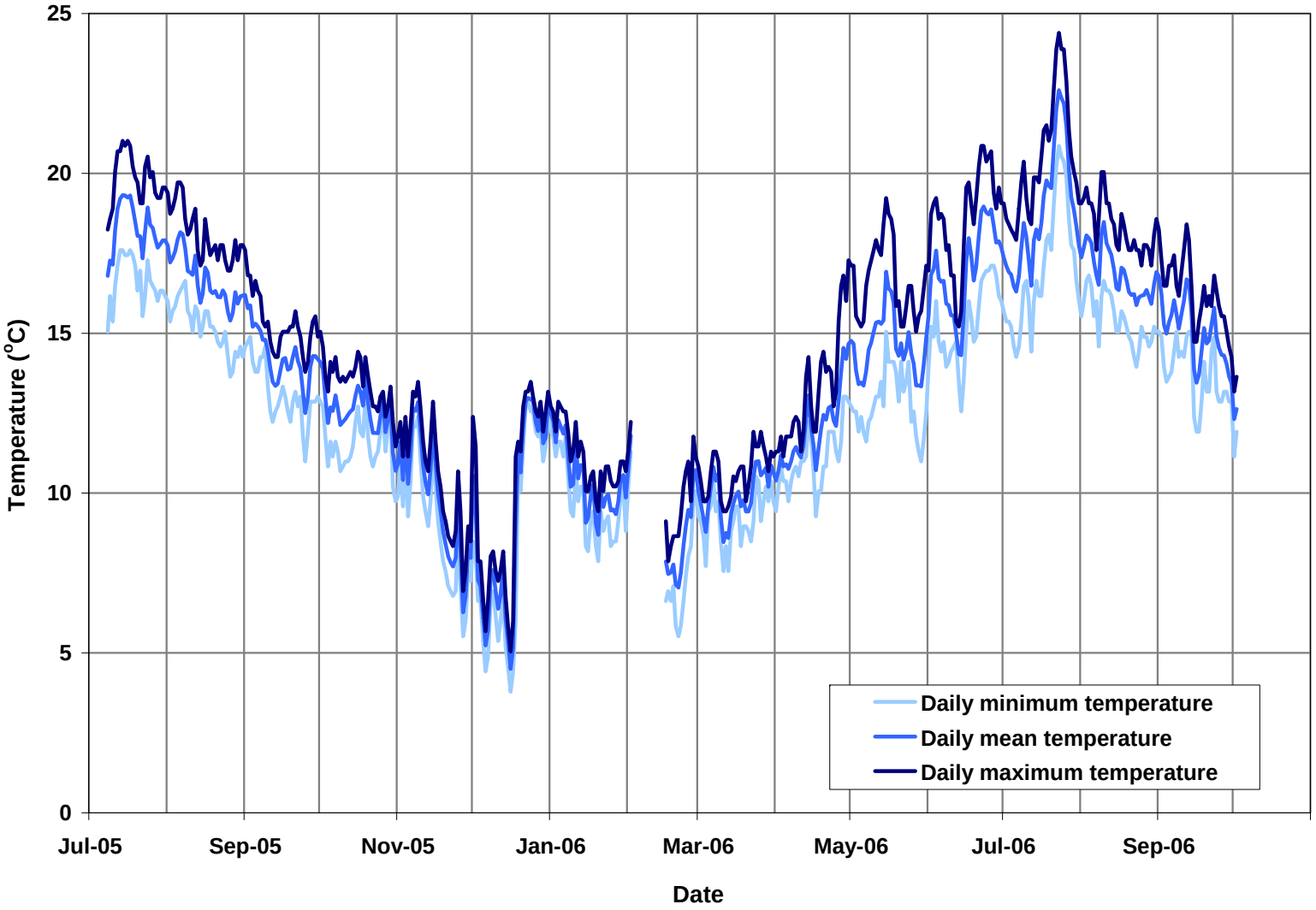

Figure 1. Continuous record of temperature in the upper reach of Redwood Creek, July 2005–October 2006.

Table 1. Flow indices of Steelhead Bioenergetics study streams during 2005 and 2006 sampling events.

Stream	Reach	Original flow designation	Baseflow during sampling (cfs)					Flow index (flow/width)				
			July 2005	Aug 2005	Oct/ Nov 2005	Feb 2006	May 2006	July 2005	Aug 2005	Oct/ Nov 2005	Feb 2006	May 2006
Heath Canyon	Lower	Lower	0.28	-	0.20	2.31	0.97	0.05	-	0.06	0.22	0.13
	Middle	Higher	0.23	-	0.19	2.36	-	0.03	-	0.06	0.22	
	Upper	Higher	0.21	0.06	0.14	1.07	0.95	0.05	0.01	0.02	0.11	0.14
	Invert	n/a	-	-	0.02	-	-	-	-	0.00	-	-
Pickle Creek	Lower	Lower	0.07	-	-	1.45	0.38	0.02	-	-	0.14	0.06
	Upper	Lower	0.05	-	0.06[a]	1.39	0.37	0.07	-	0.03[a]	0.17	0.07
Redwood Creek	Lower	Lower	1.18	0.34	0.47	12.02	8.16	0.12	0.05	0.05	1.01	0.76
	Upper	Higher	0.54	-	0.30	8.02	3.96	0.06	-	0.06	0.50	0.17
	Invert	n/a	-	-	0.08	-	-	-	-	0.02	-	-
Ritchey Creek	Lower	Higher	0.20	0.50	0.24	2.29	1.30	0.04	0.04	0.04	0.18	0.11
	Middle	Higher	0.41	0.42	0.30	-	-	0.04	0.09	0.04	-	-
	Upper	Higher	0.43	0.41	0.42	1.88	1.40	0.08	0.06	0.07	0.19	0.17
	Invert	n/a	-	-	0.22	-	-	-	-	0.04	-	-
York Creek	Lower	Higher	0.70	-	0.43	3.73	2.15	0.10	-	0.11	0.35	0.18
	Upper	Higher	0.76	-	0.57	-	2.02	0.13	-	0.08	-	0.21
	Invert	n/a	-	-	0.14	-	-	-	-	0.03	-	-

[a] Measurement was taken in 2006.

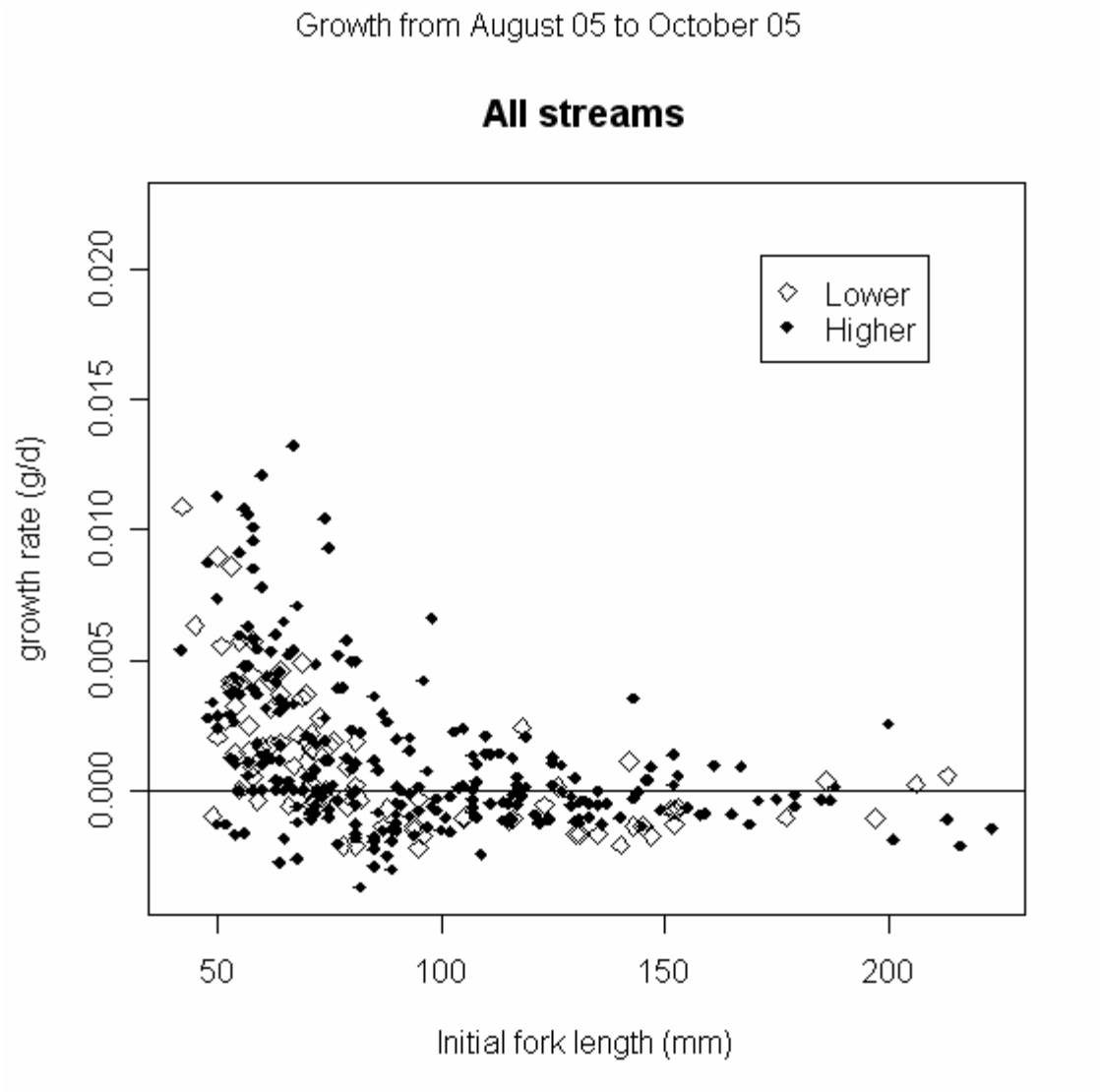

Figure 2. Initial fork length and growth (grams/day) of marked steelhead in lower-flow and higher-flow study streams, August 2005–October 2005.

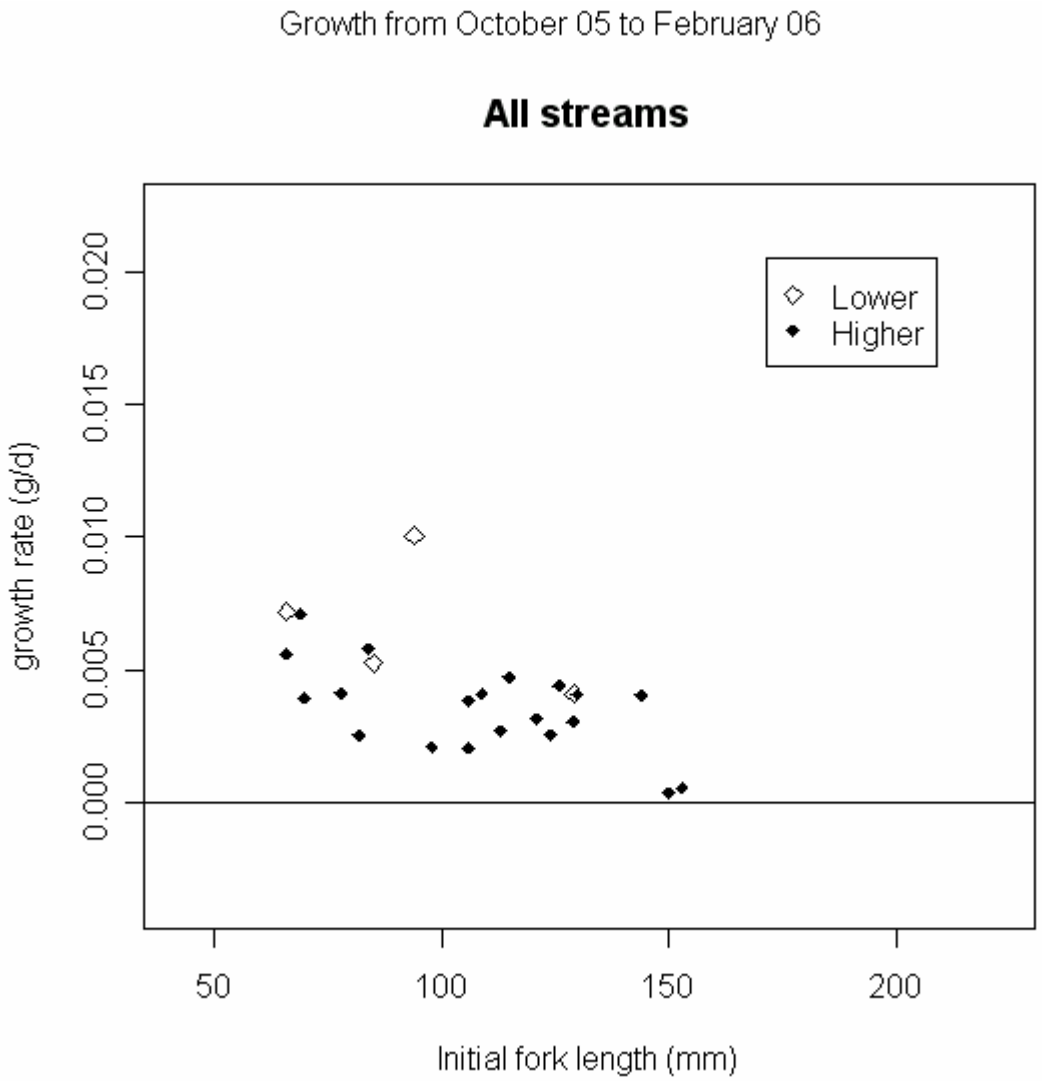

Figure 3. Initial fork length and growth (grams/day) of marked steelhead in lower-flow and higher-flow study streams, October 2005–February 2006.

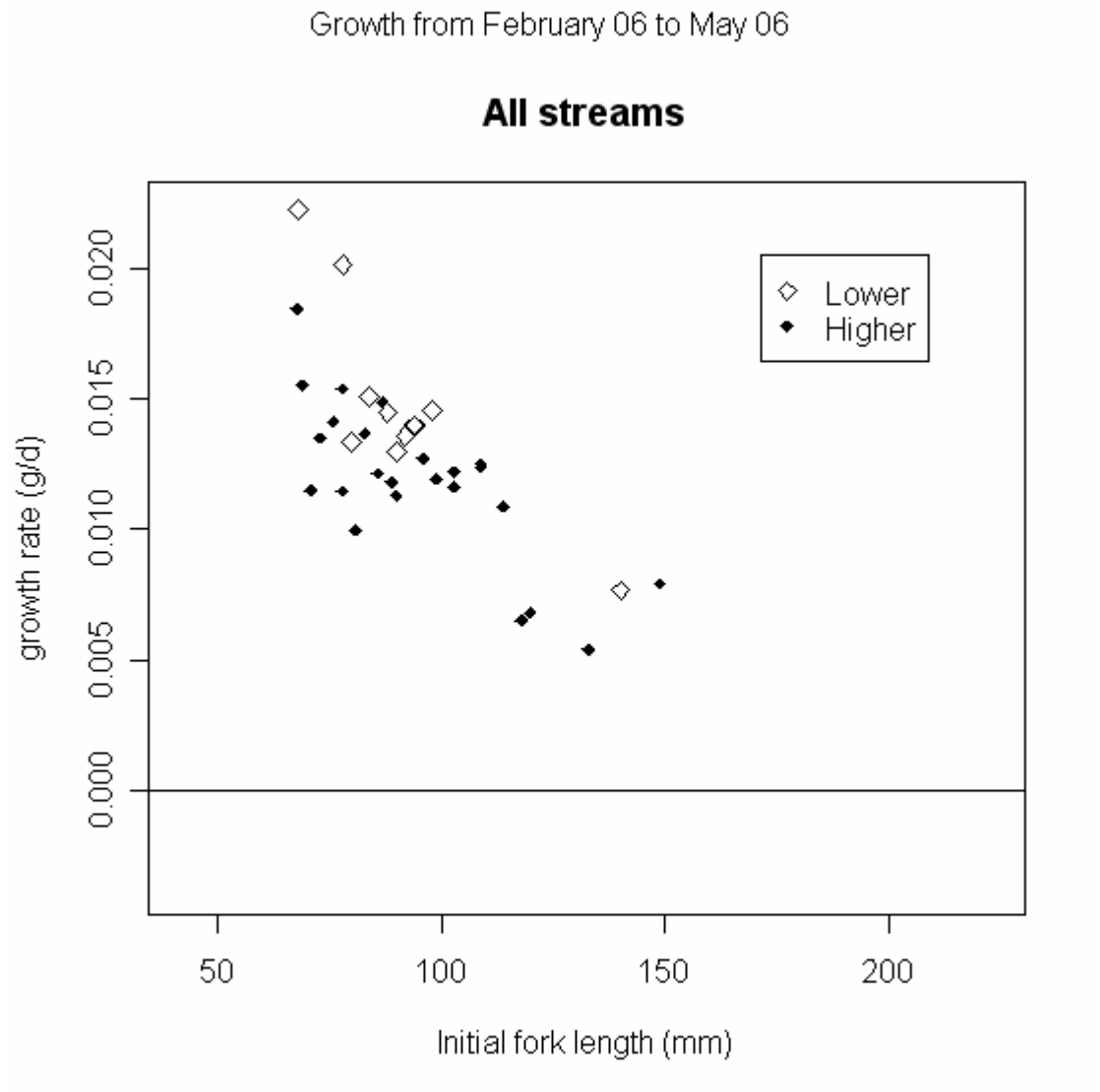

Figure 4. Initial fork length and growth (grams/day) of marked steelhead in lower-flow and higher-flow study streams, February–May 2006.

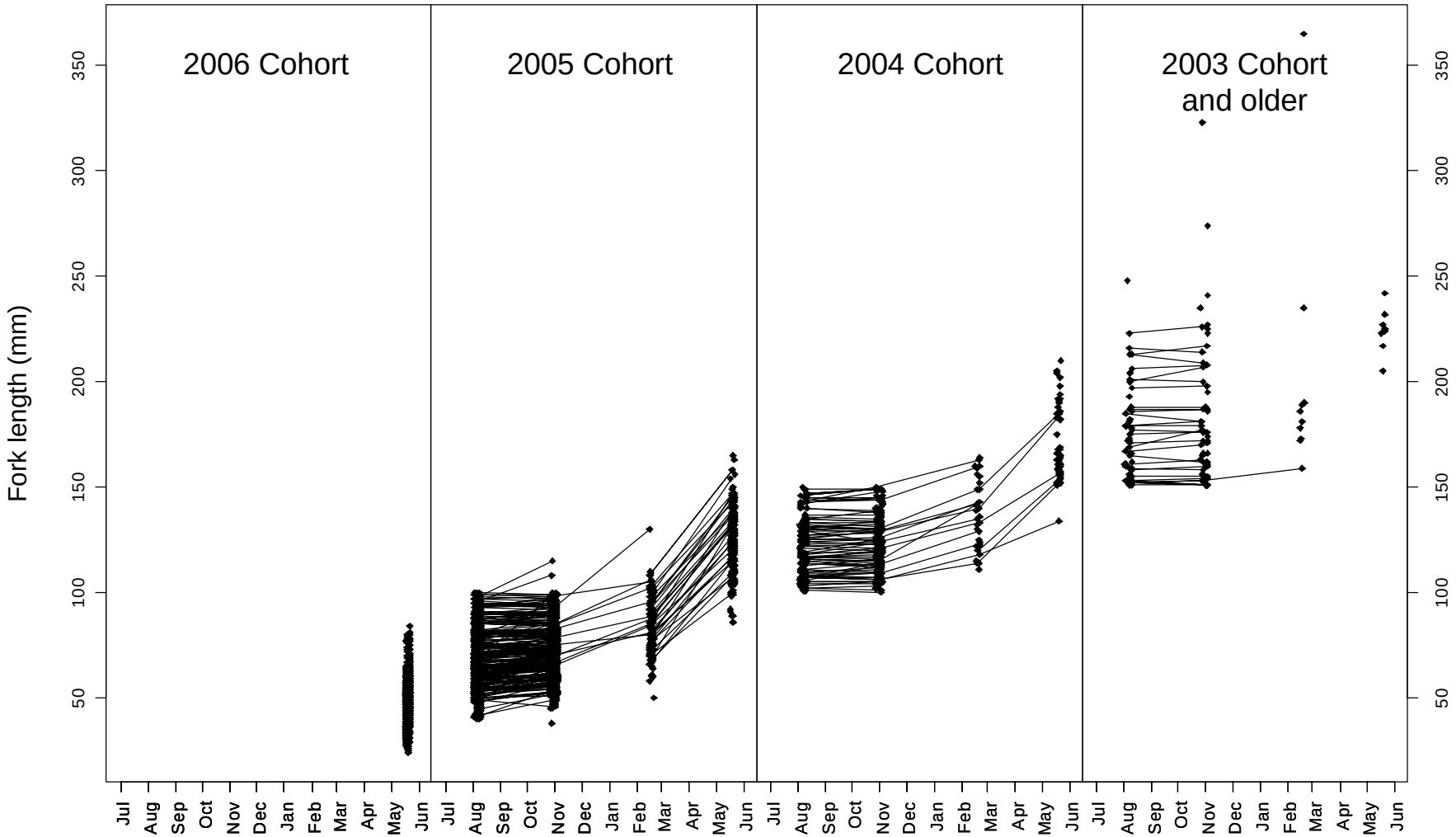

Figure 5. Steelhead size and growth. Solid diamonds mark the sizes of individual fish, successive measurements of the same individual are joined by line segments. All figures show 2005–2006 data, separated into nominal "cohorts" based on length-at-age determined from scale analysis.

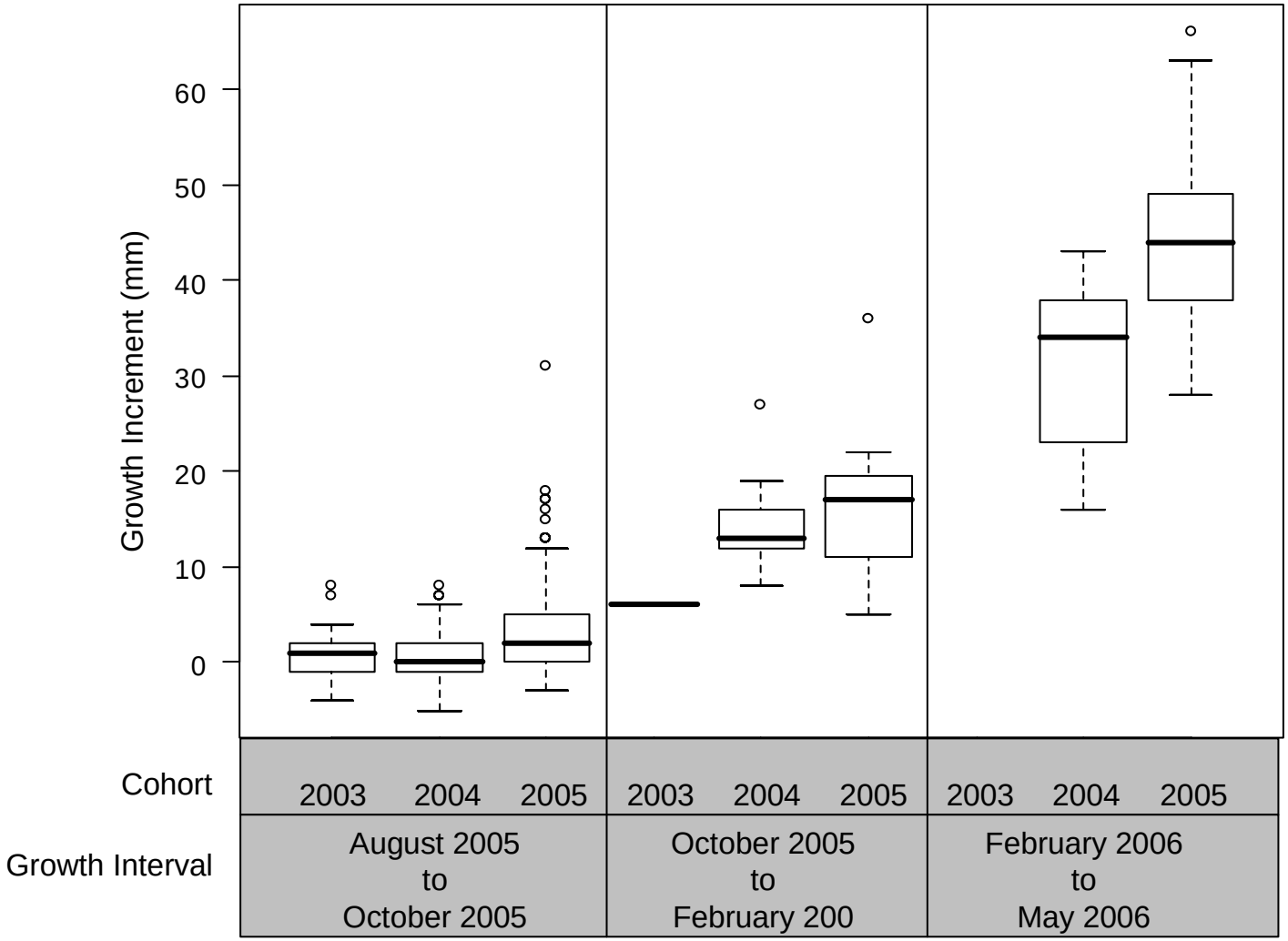

Figure 6. Box and whisker plots comparing steelhead growth among age cohorts for each seasonal growth interval. Boxes represent the 25-75% range of values, and the heavy line within the boxes represents the median. Boxes that do not overlap indicate significantly different median values.