Mechanical Removal of Non-Native Fishes in Grand Canyon

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U.S. Department of the Interior
U.S. Geological Survey

Objectives

- Efficacy of Mechanical Removal of Adult RBT and BNT from the LCR Inflow Reach.
  - To what extent can we remove non-native fishes from a large reach of the Colorado River?
- Rainbow and Brown Trout Diet Analysis and Predation.
  - Next Set of Talks by Mike Yard and others.
- Effect of Adult RBT and BNT on the Population Dynamics of the LCR HBC Population.
  - Will humpback chub recruitment increase as a result of non-native removal?

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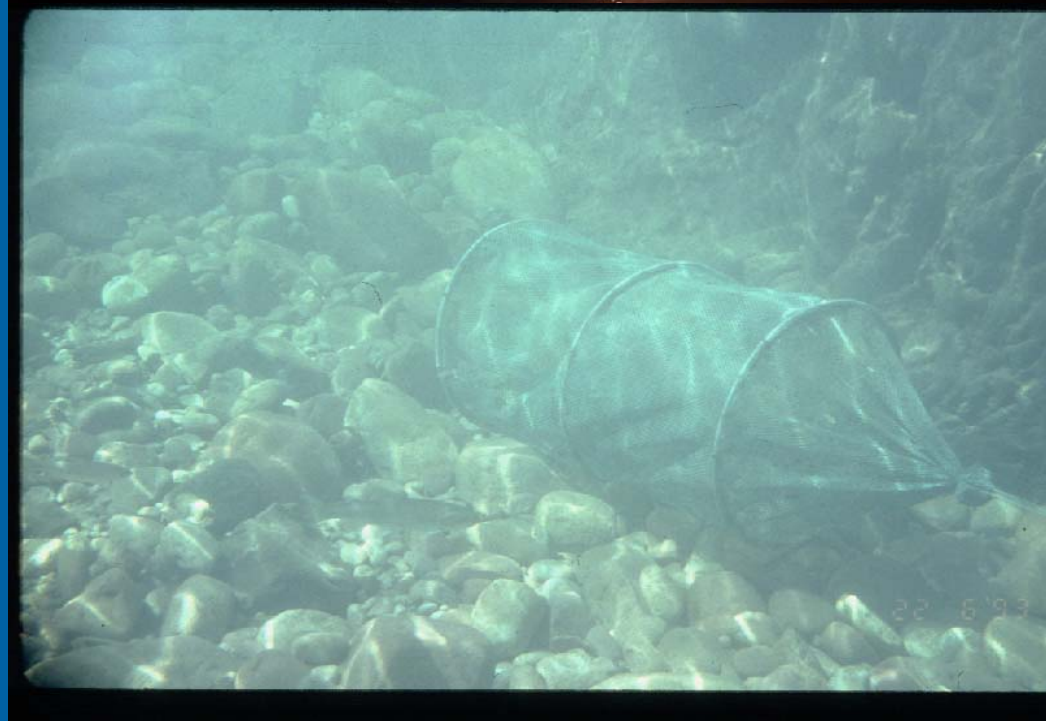
Methods - Mechanical Removal Trips

- 4 years - 6 trips/year
  - Jan, Feb, Mar (Winter)
  - Jul, Aug, Sep (Summer)
  - First 3 Years Completed
- Sampling Methods:
  - Electrofishing
    - Control Reach
    - Removal Reach(s)
  - Hoopnetting
    - Removal Reaches
    - Estimate relative abundance of native fish (Juveniles).



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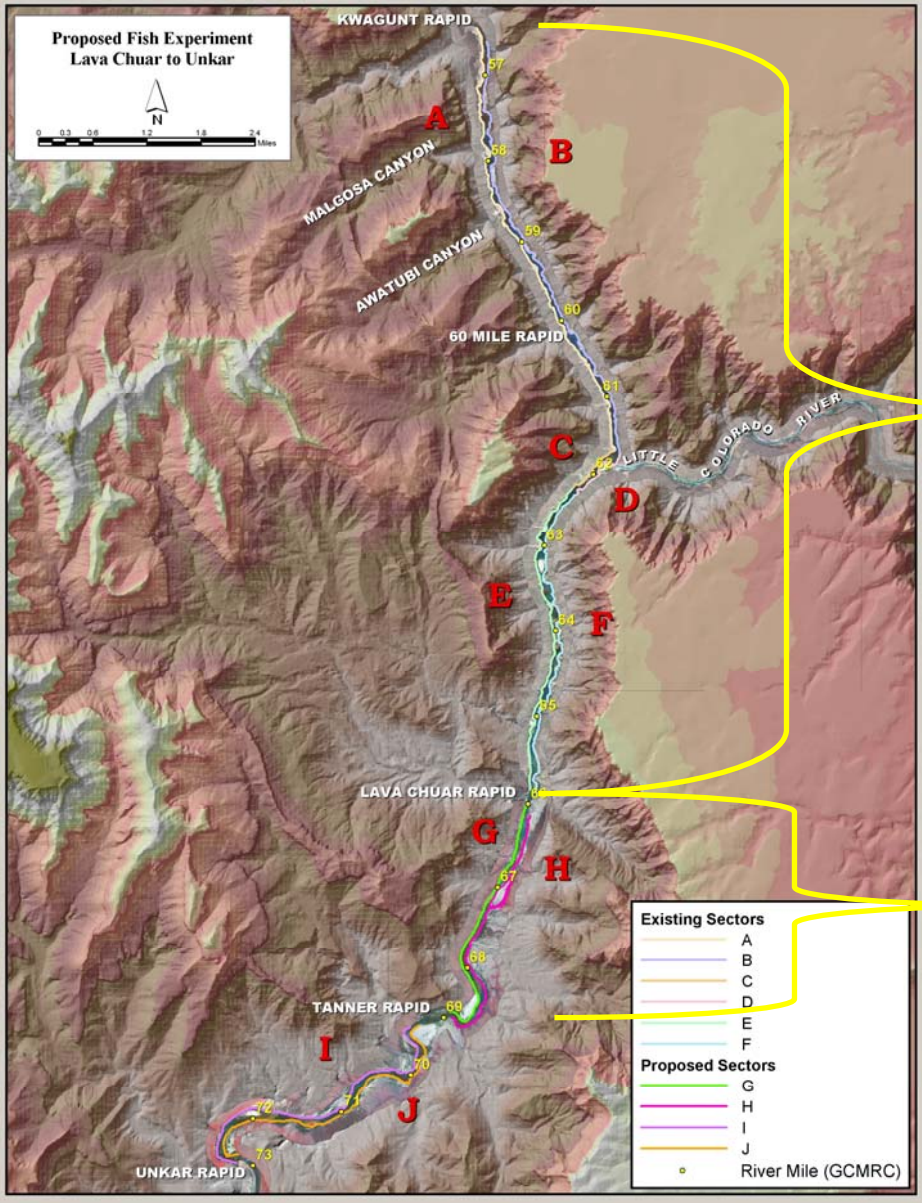
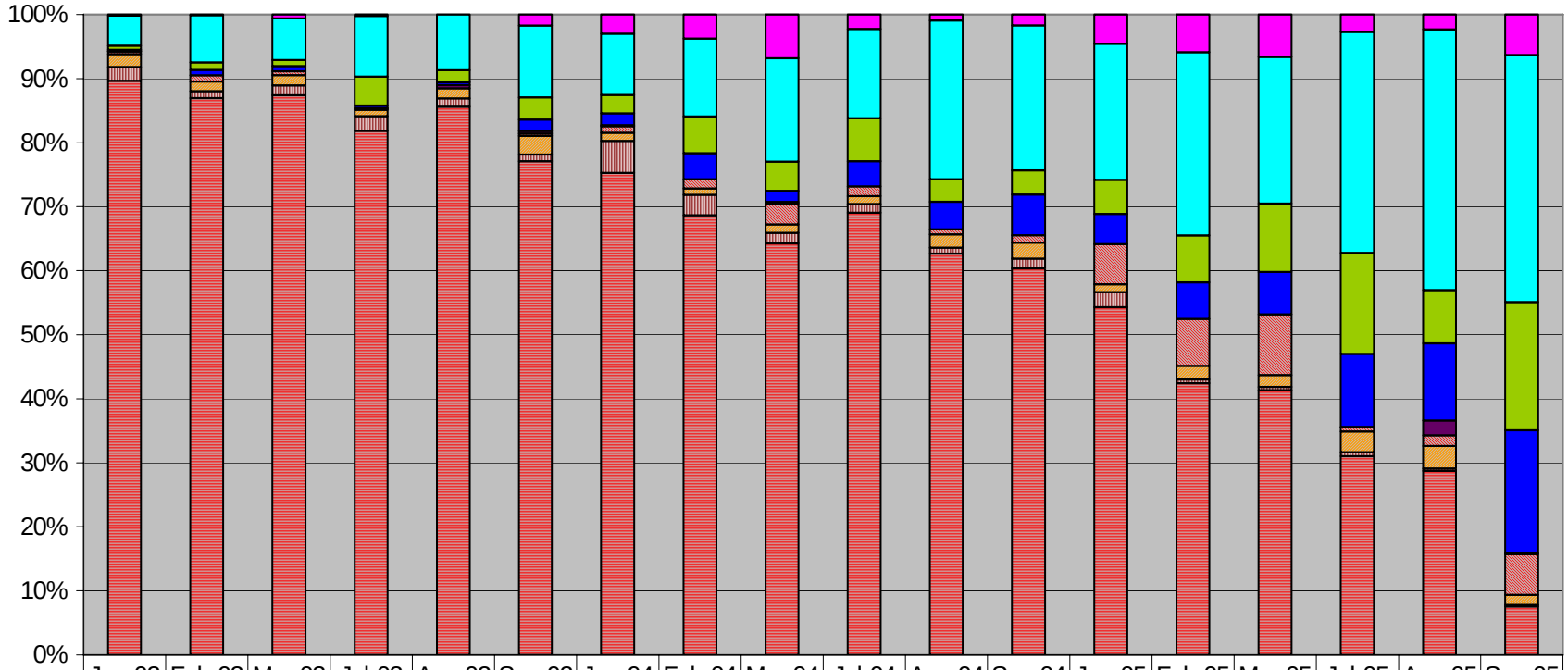
Mechanical Removal Reaches



Little Colorado River Removal Reach (Kwagunt Rapid to Lava Chuar Rapid, 9.5 miles)

Lava Chuar to Tanner Removal Reach, 2.8 miles

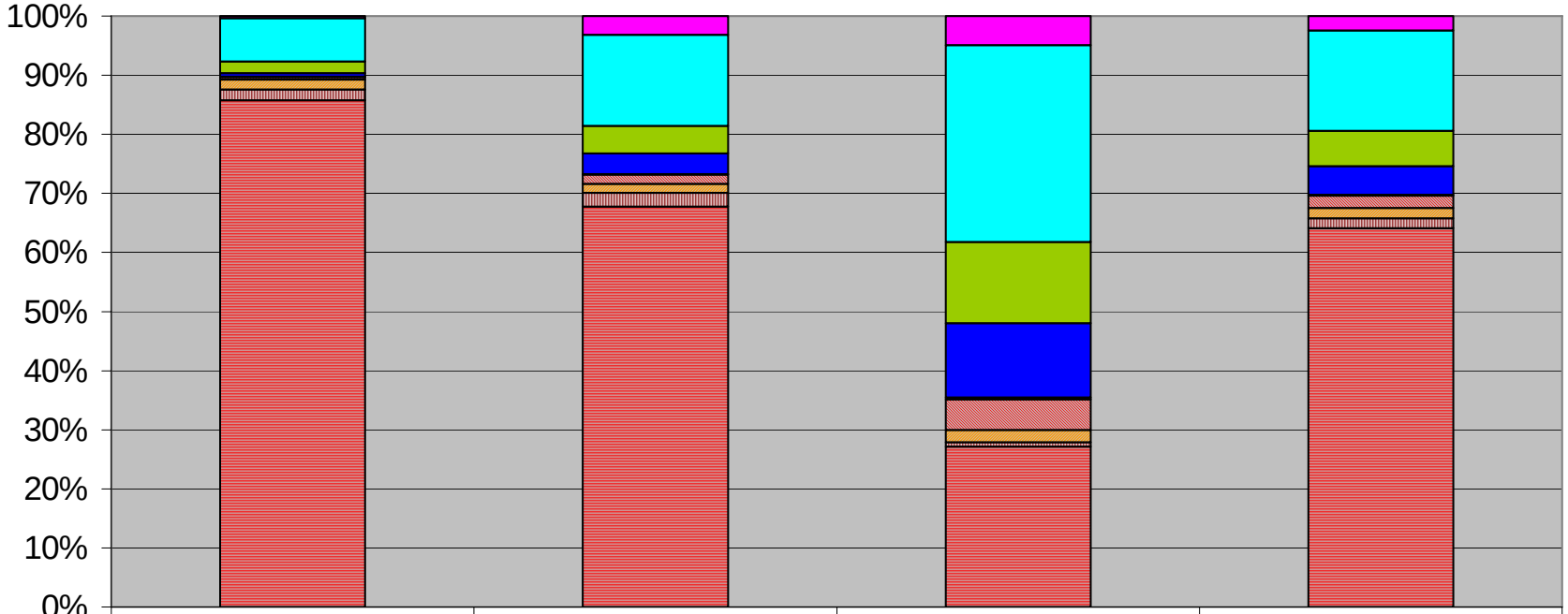
Results-LCR Reach Electrofishing Catch



	Jan-03	Feb-03	Mar-03	Jul-03	Aug-03	Sep-03	Jan-04	Feb-04	Mar-04	Jul-04	Aug-04	Sep-04	Jan-05	Feb-05	Mar-05	Jul-05	Aug-05	Sep-05
Speckled Dace	7	2	8	6		18	53	34	92	47	7	19	52	39	51	38	24	190
Flannelmouth Sucker	188	161	89	266	79	119	169	110	218	296	190	258	244	191	176	480	419	1166
Humpback Chub	26	26	13	126	17	37	51	52	61	142	27	43	61	49	82	220	86	604
Bluehead Sucker	8	18	11	12	4	19	32	37	24	84	33	72	54	38	51	159	124	579
Unidentified Sucker	2	0	0	3	5	4	3	0	3	0	0	0	0	0	0	1	24	4
Fathead Minnow	17	21	8	4	0	4	18	13	44	32	6	13	72	49	73	9	17	193
Common Carp	80	33	22	29	14	31	23	9	18	26	16	29	14	14	14	45	36	47
Brown Trout	87	24	21	63	12	11	88	29	22	29	7	17	27	4	4	9	4	7
Rainbow Trout	3605	1900	1195	2298	779	818	1330	622	867	1464	480	687	623	283	318	432	296	229

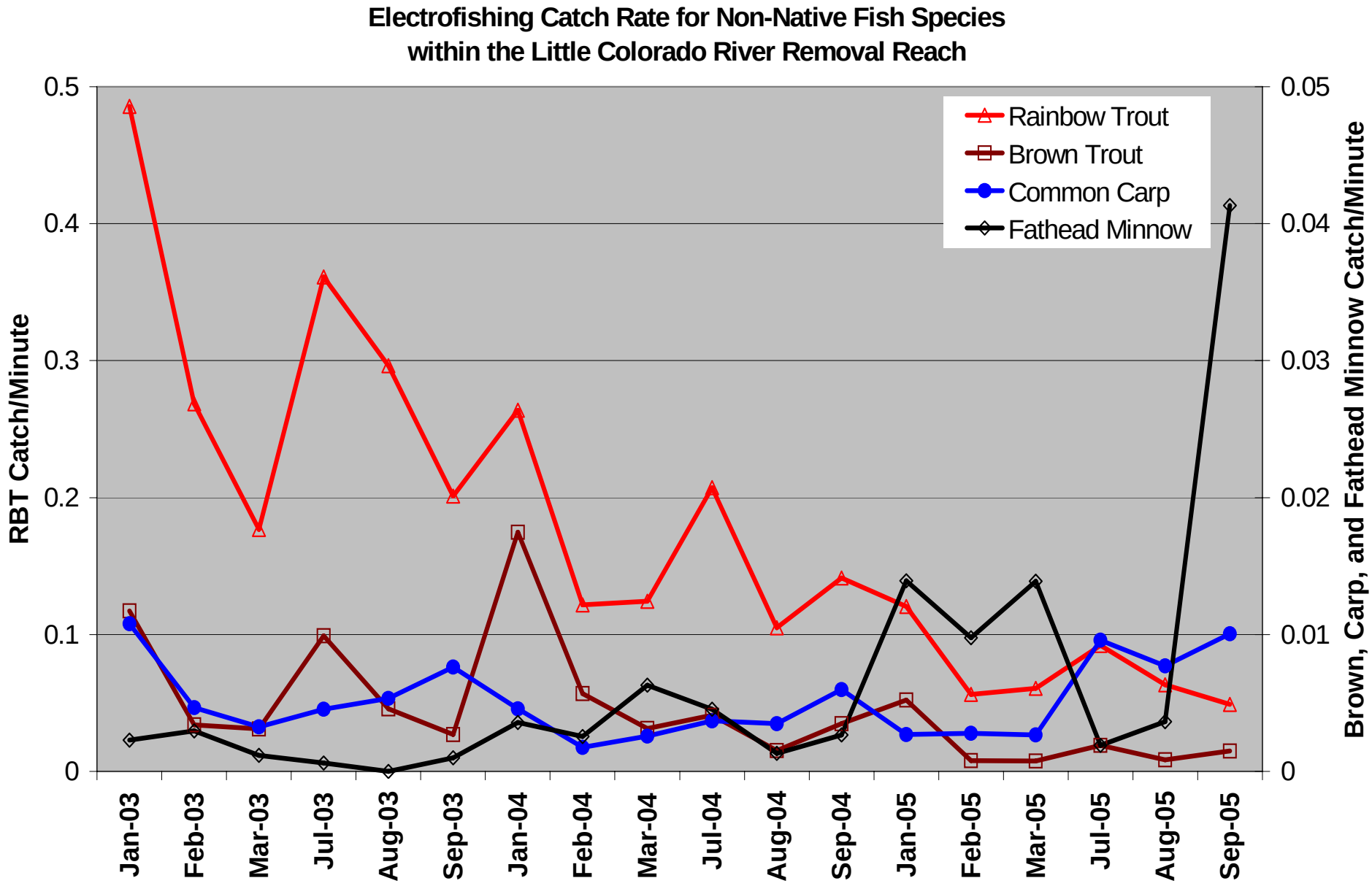
Results-LCR Reach Electrofishing Catch

Electrofishing Catch by Species and Year within the Little Colorado River Removal Reach

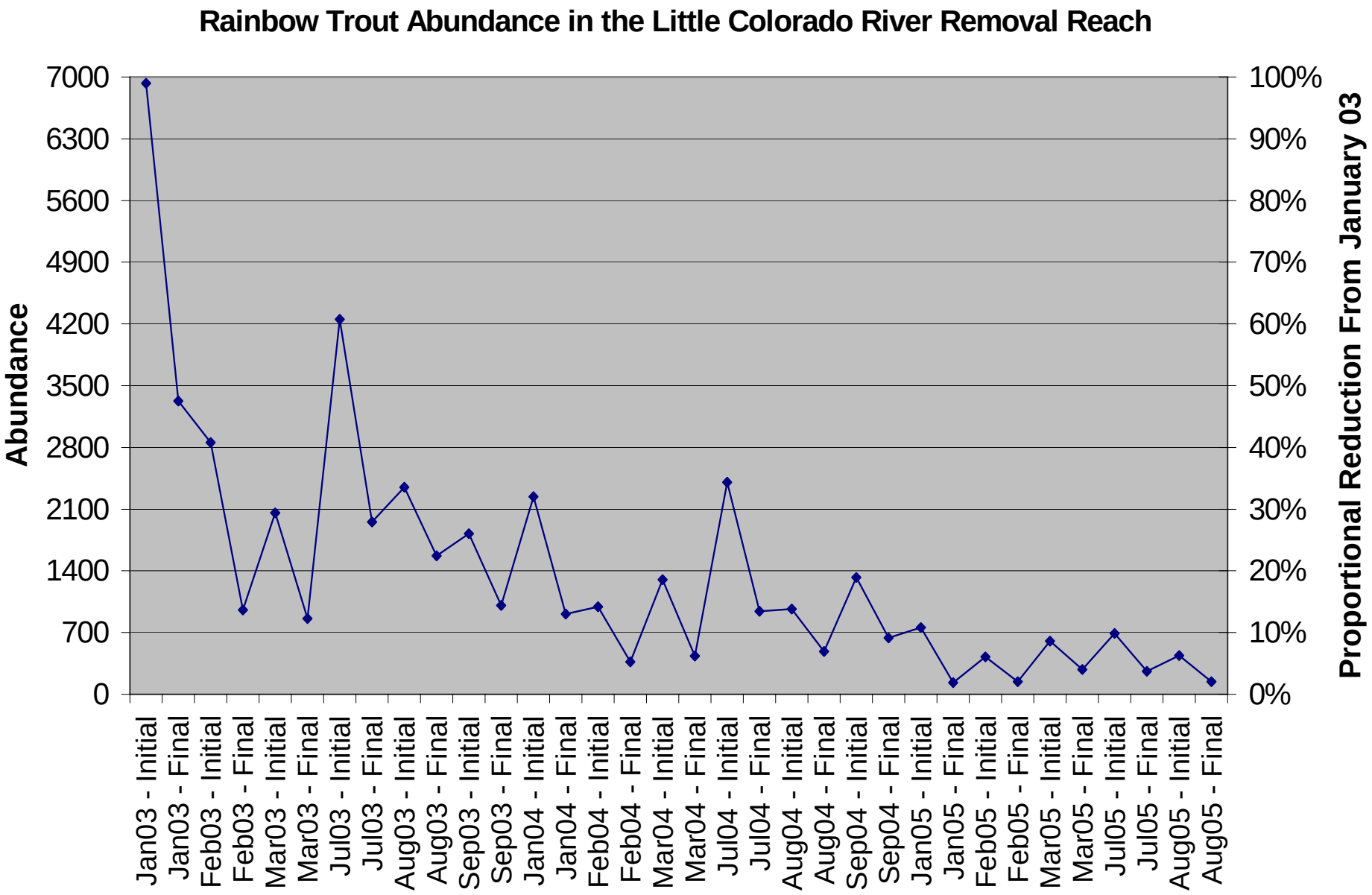


	Total 03	Total 04	Total 05	Total 03-05
Speckled Dace	41	252	394	687
Flannelmouth Sucker	902	1241	2676	4819
Humpback Chub	245	376	1102	1723
Bluehead Sucker	72	282	1005	1359
Unidentified Sucker	14	6	29	49
Fathead Minnow	54	126	413	593
Common Carp	209	121	170	500
Brown Trout	218	192	55	465
Rainbow Trout	10595	5450	2181	18226

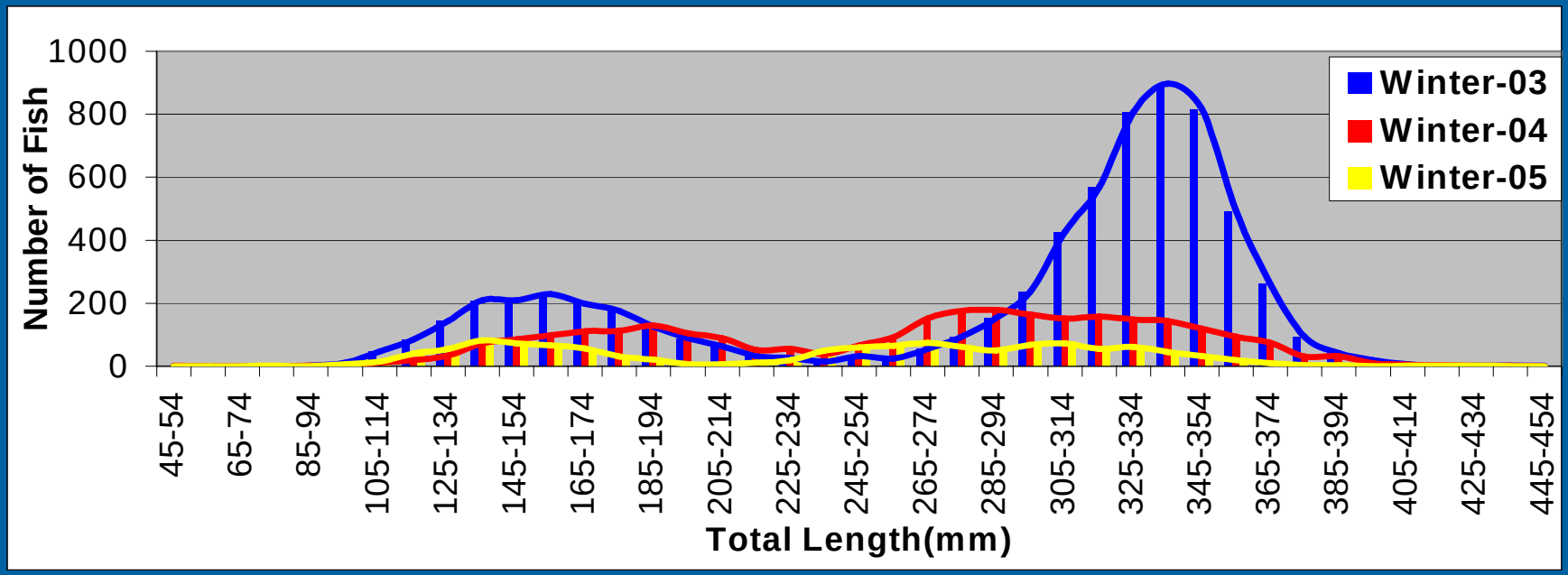
Results-LCR Reach Non-native Abundance

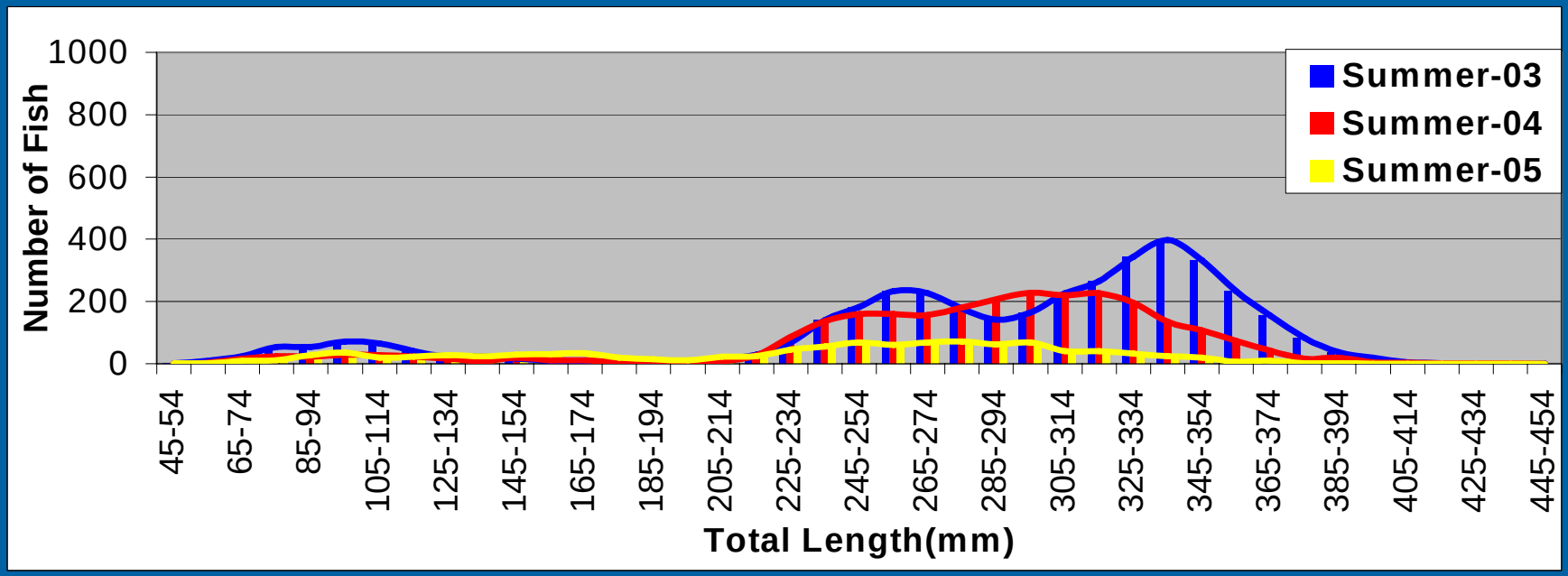


Results-LCR Reach Rainbow Trout Abundance

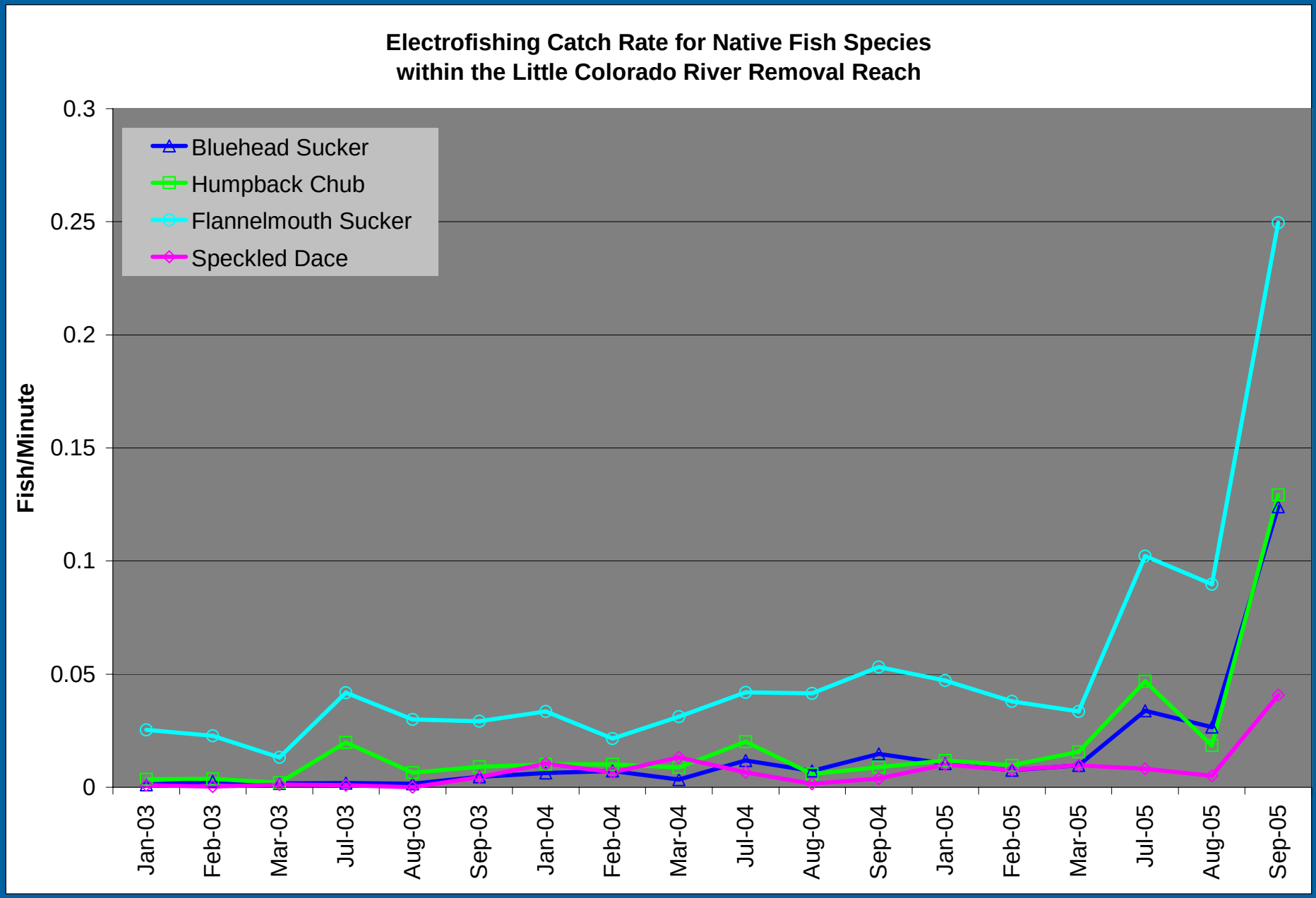


Length Composition of LCR Rainbow Trout

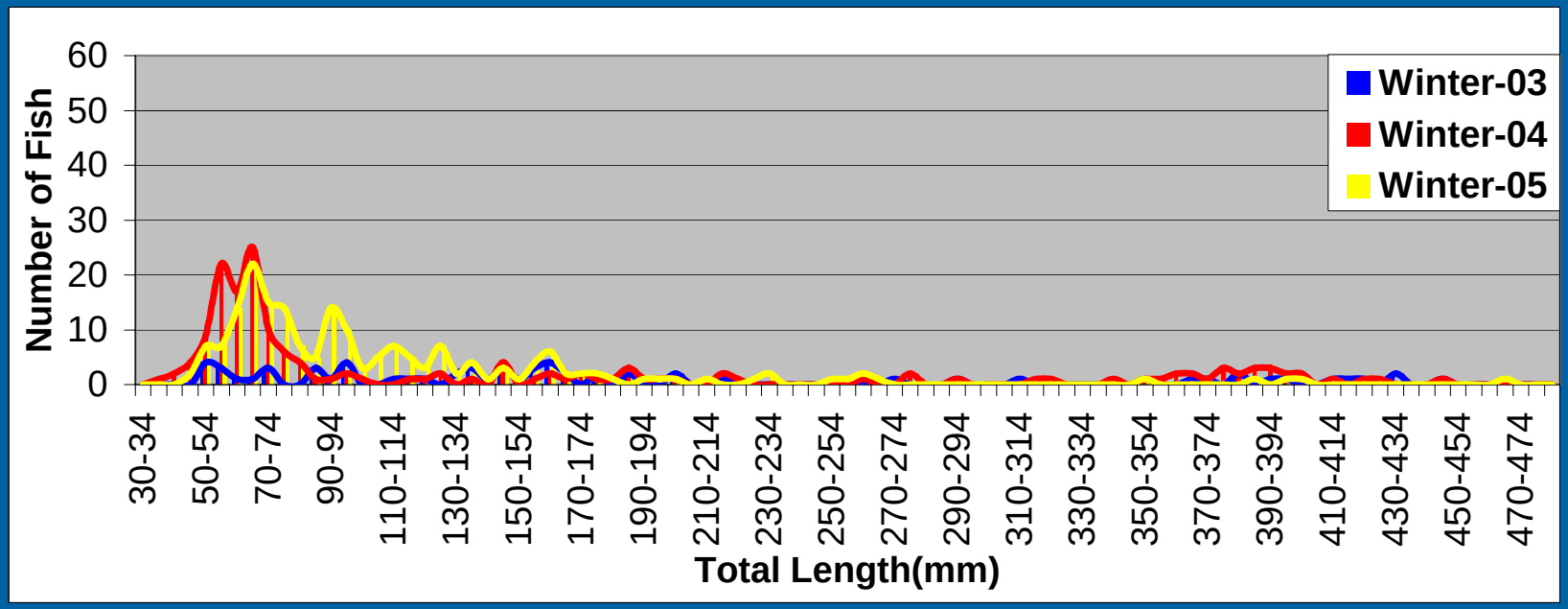


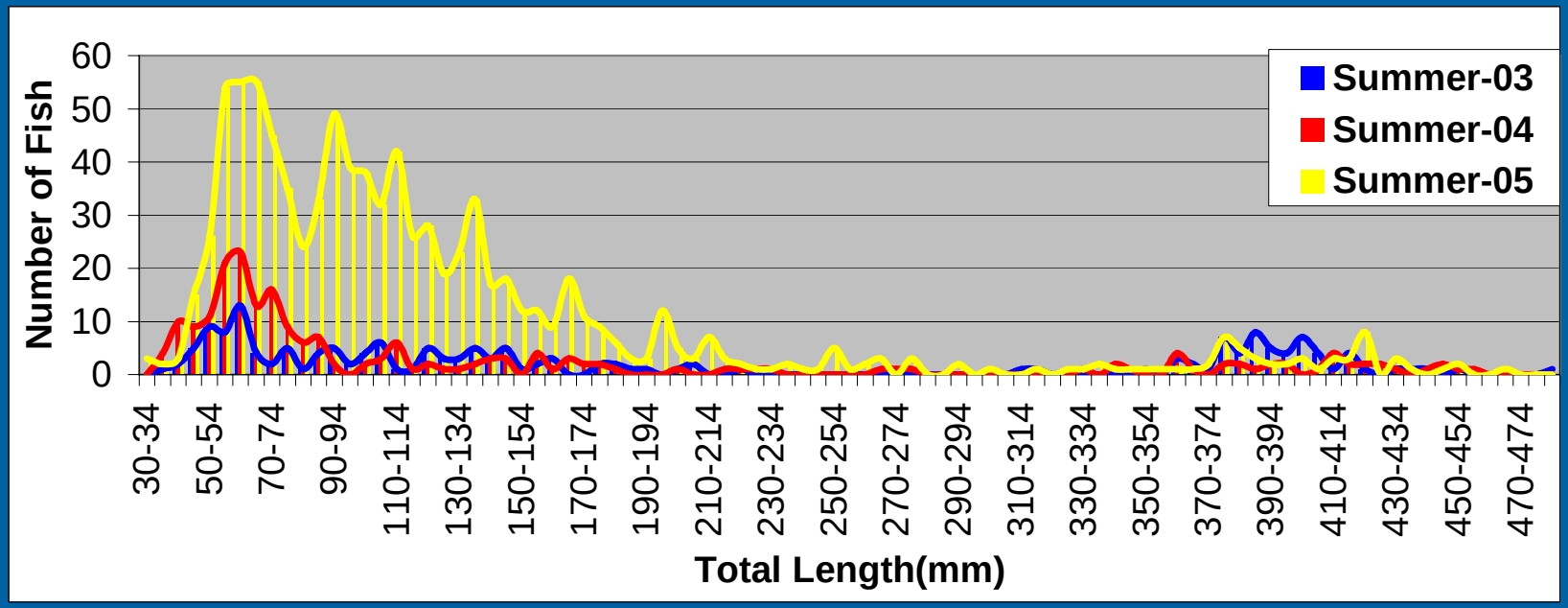


Results-LCR Reach Native Abundance

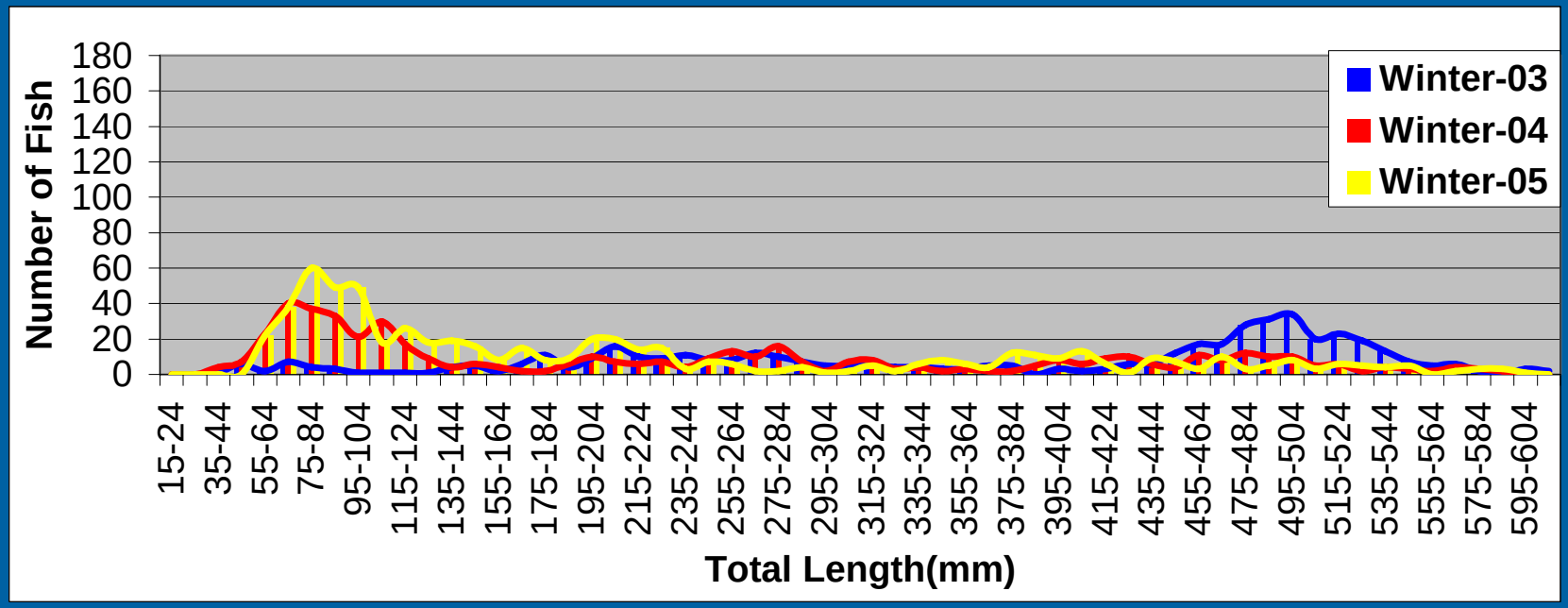


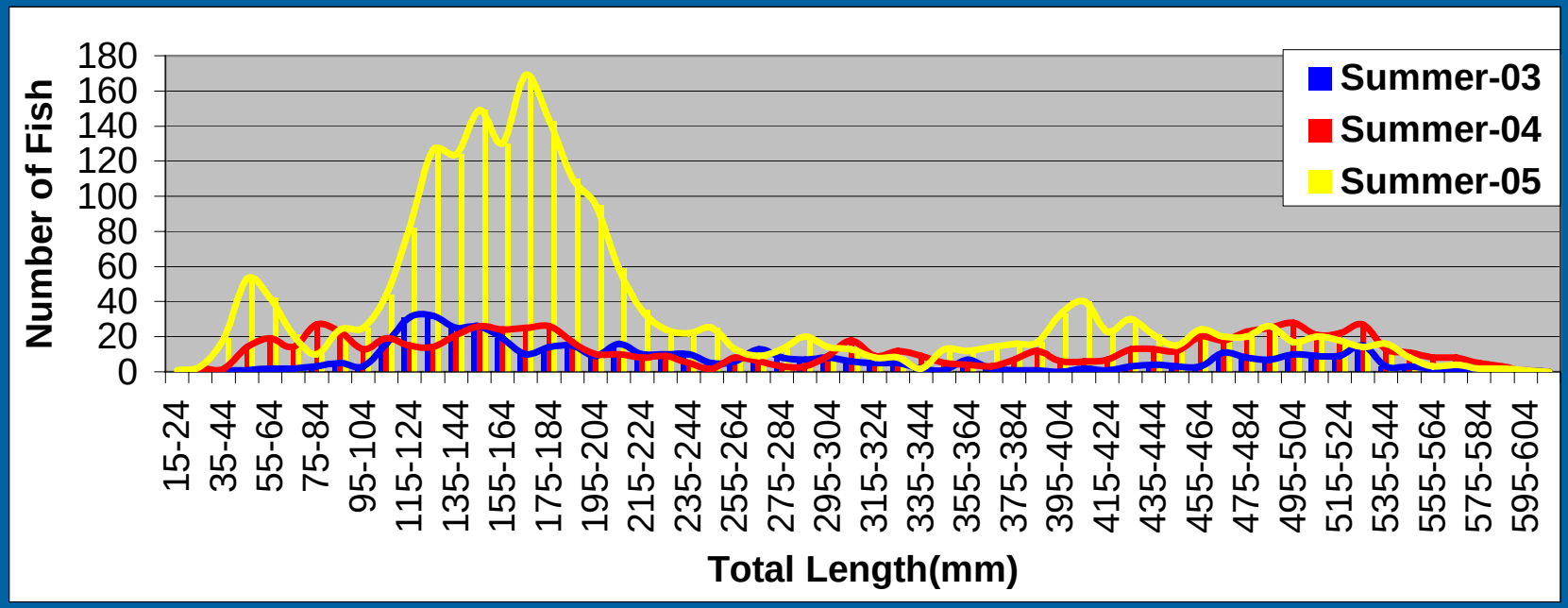
Length Composition of LCR Humpback Chub



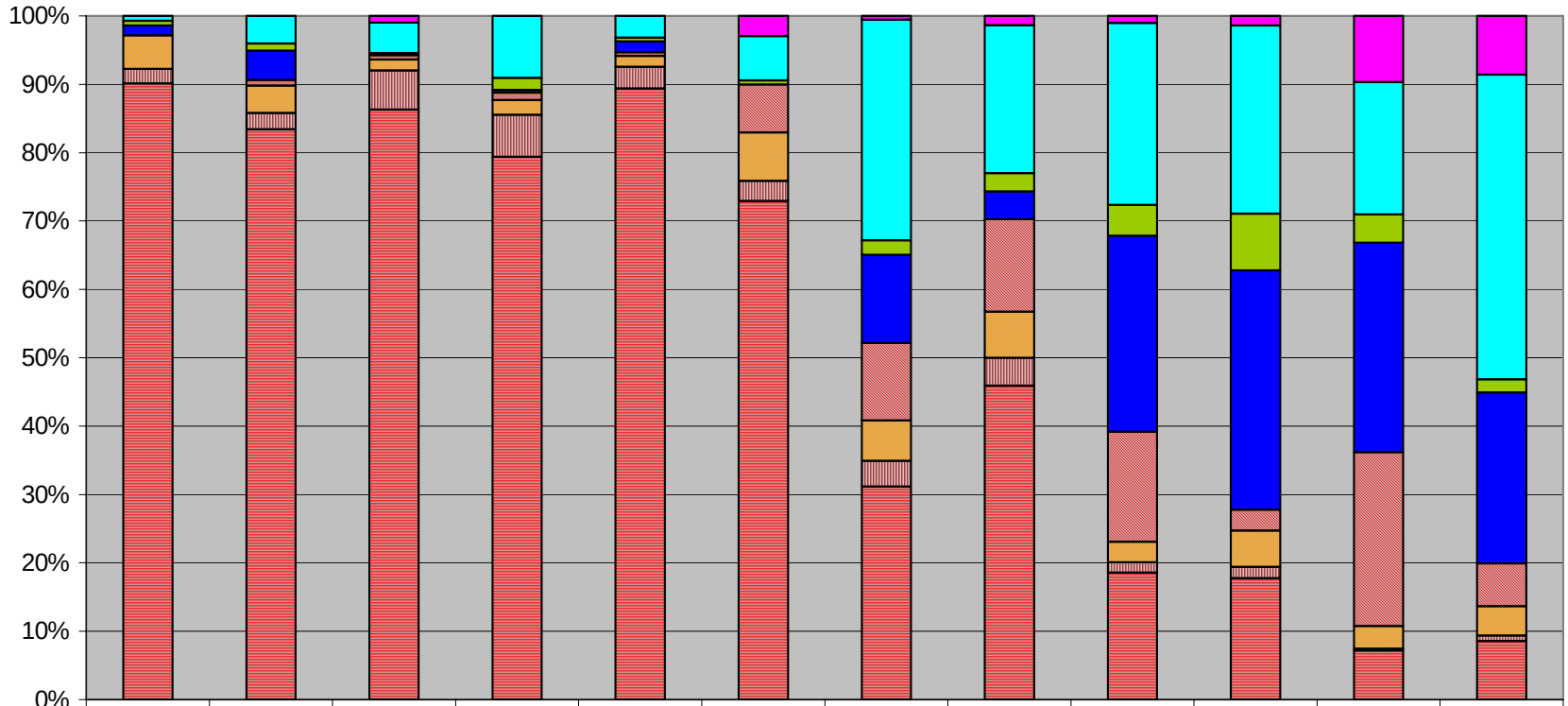


Length Composition of LCR Flannelmouth Sucker





Results-Lava Chuar to Tanner Reach Electrofishing Catch



	Aug-03	Sep-03	Jan-04	Feb-04	Aug-04	Sep-04	Jan-05	Feb-05	Mar-05	Jul-05	Aug-05	Sep-05
Speckled Dace			3			5	1	1	2	5	35	22
Flannelmouth Sucker	1	15	14	25	6	11	60	16	53	99	70	114
Humpback Chub	1	4	1	5	1	1	4	2	9	30	15	5
Bluehead Sucker	2	16		1	3		24	3	57	126	111	64
Fathead Minnow		3	2	3	1	12	21	10	32	11	92	16
Common Carp	7	15	5	6	3	12	11	5	6	19	12	11
Brown Trout	3	9	18	17	6	5	7	3	3	6	1	2
Rainbow Trout	128	312	271	220	169	124	58	34	37	64	26	22

Control Reach Sampling

- Control Reach (RM 44-52)
  - Purpose is to evaluate changes in trout abundance and size distribution that are a result of factors other than mechanical removal (e.g. fluctuating flows)
  - Sampled one night each trip.

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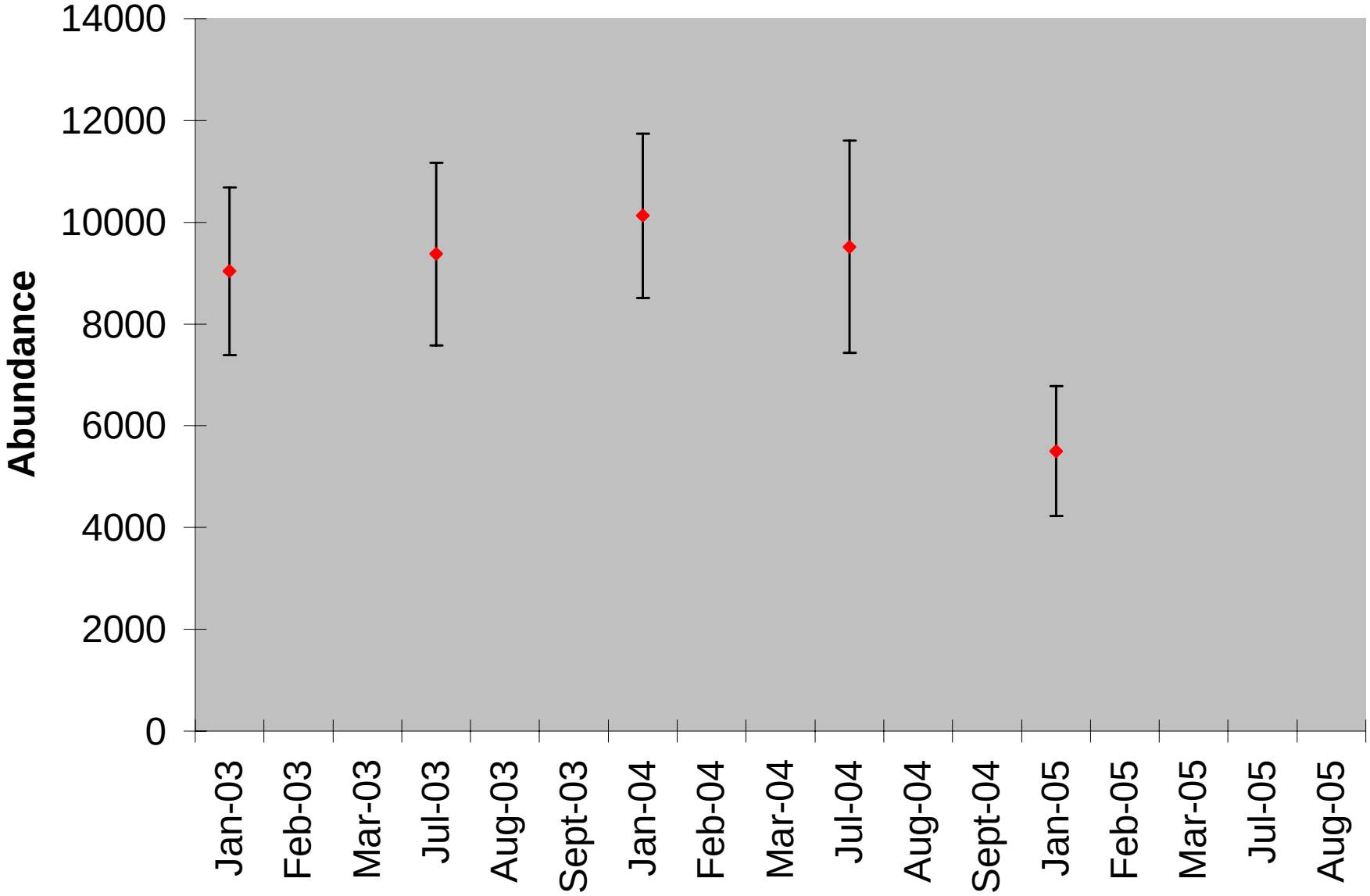
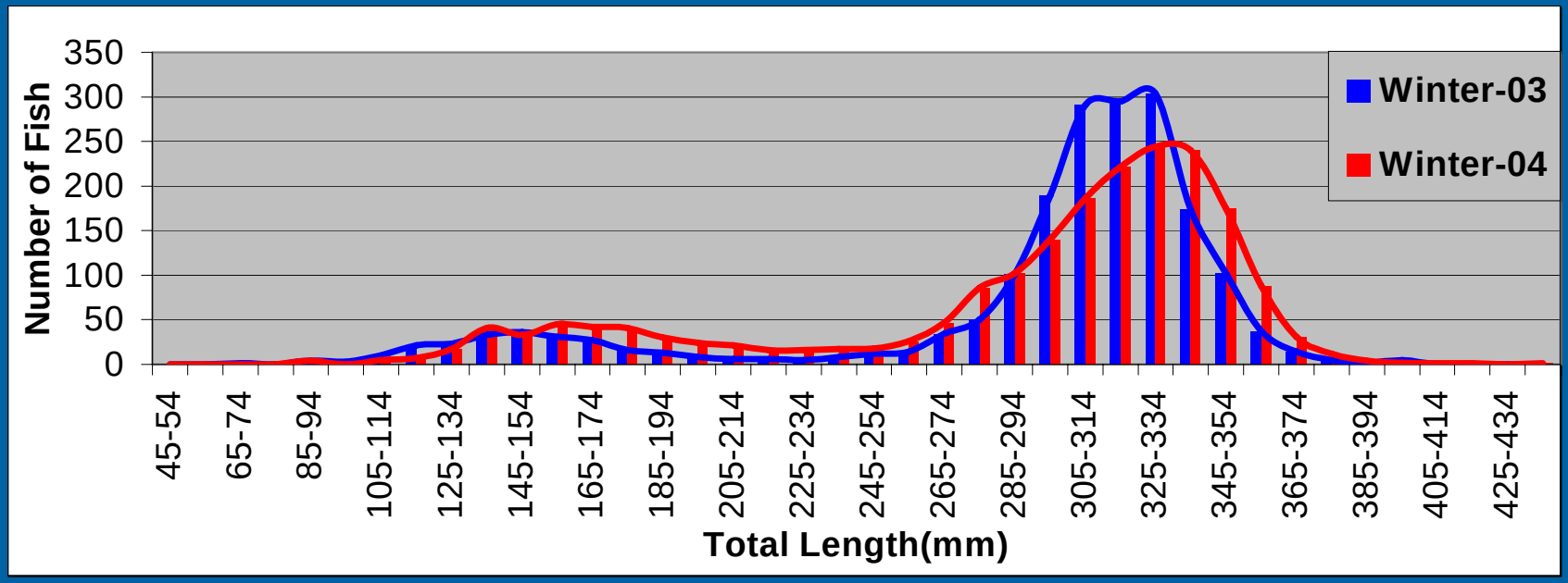
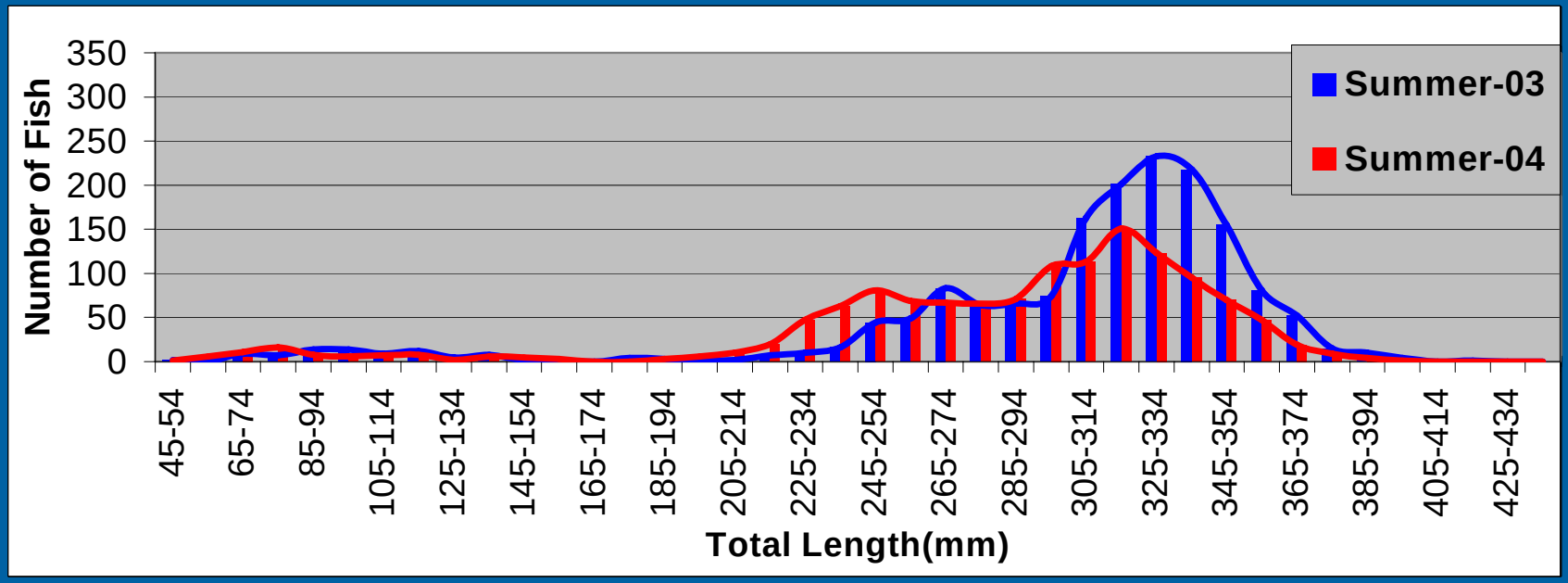
Rainbow Trout Abundance in the Control Reach



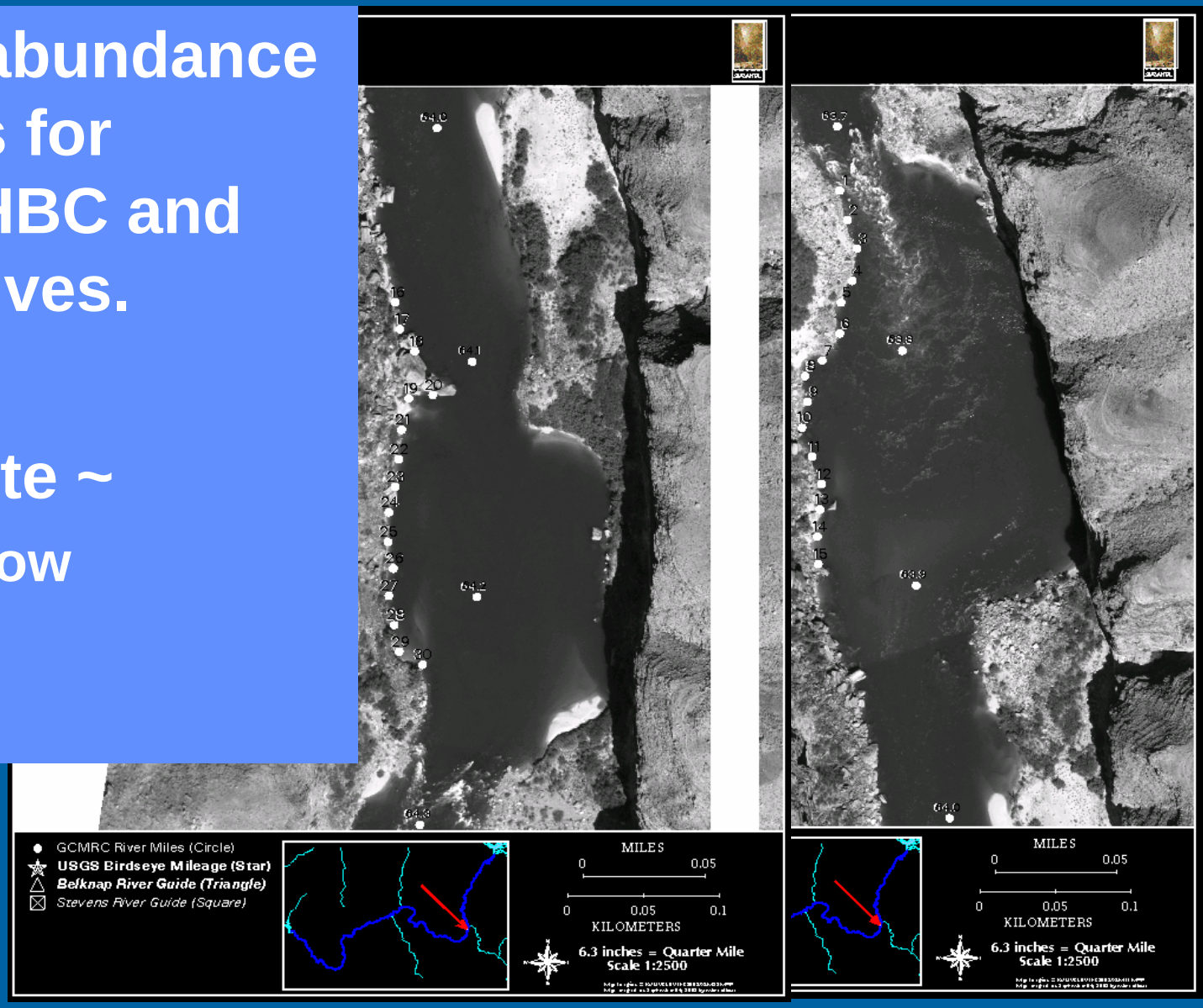
Length Composition of Control Reach Rainbow Trout





Hoopnetting

- Relative abundance estimates for juvenile HBC and other natives.
- 30 sets/site ~
  - LCR Inflow
  - Tanner
  - Unkar



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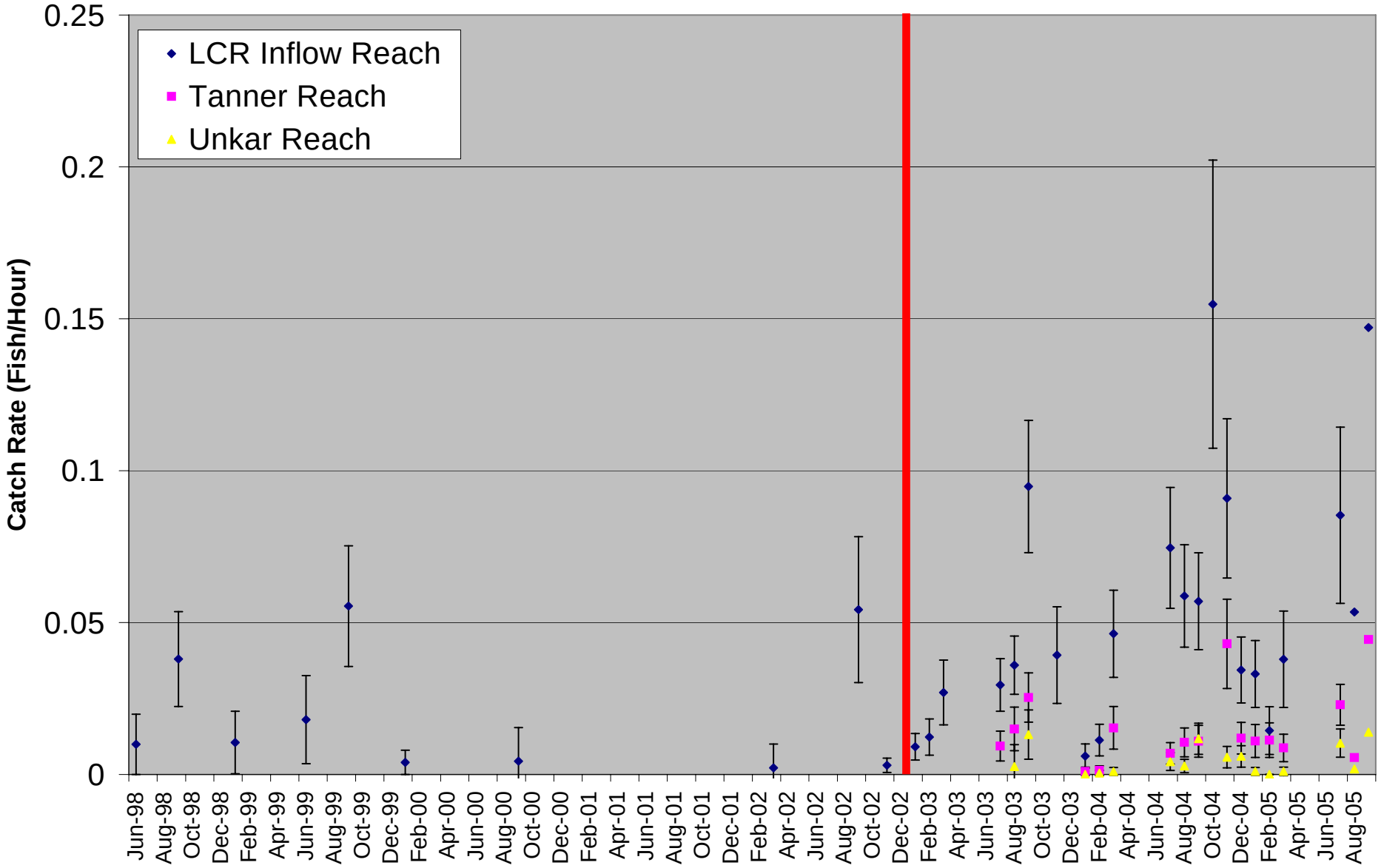
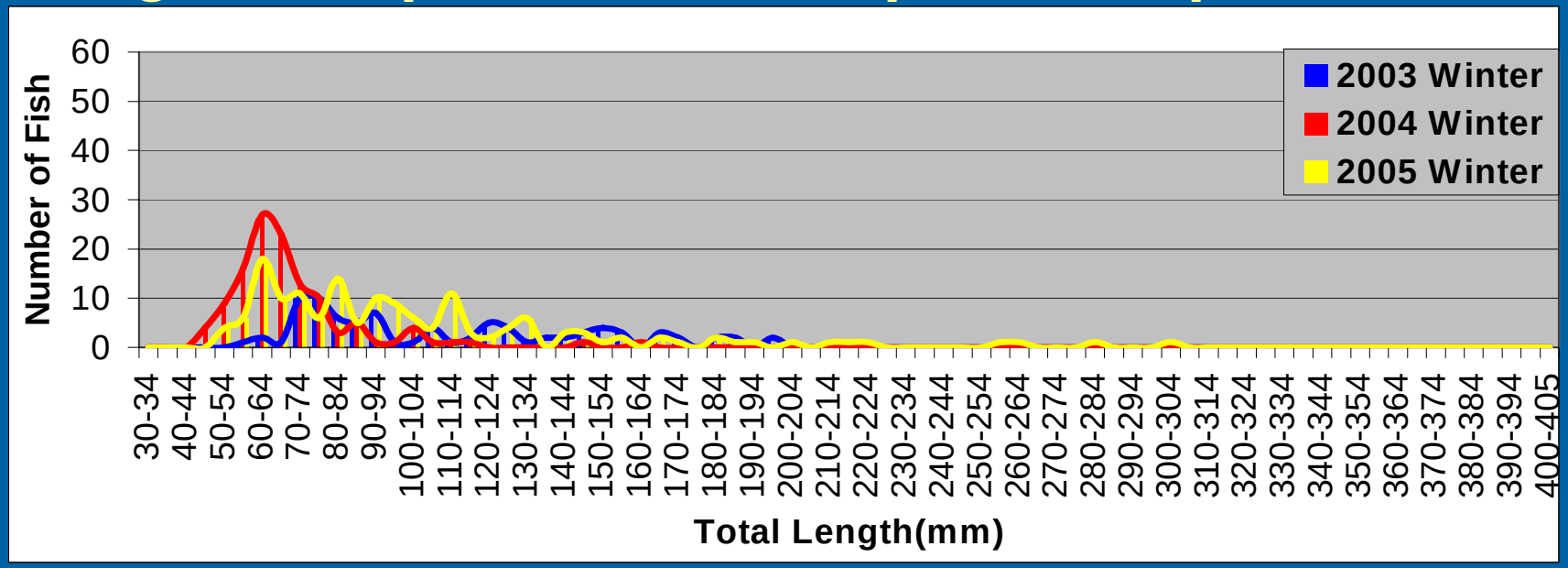
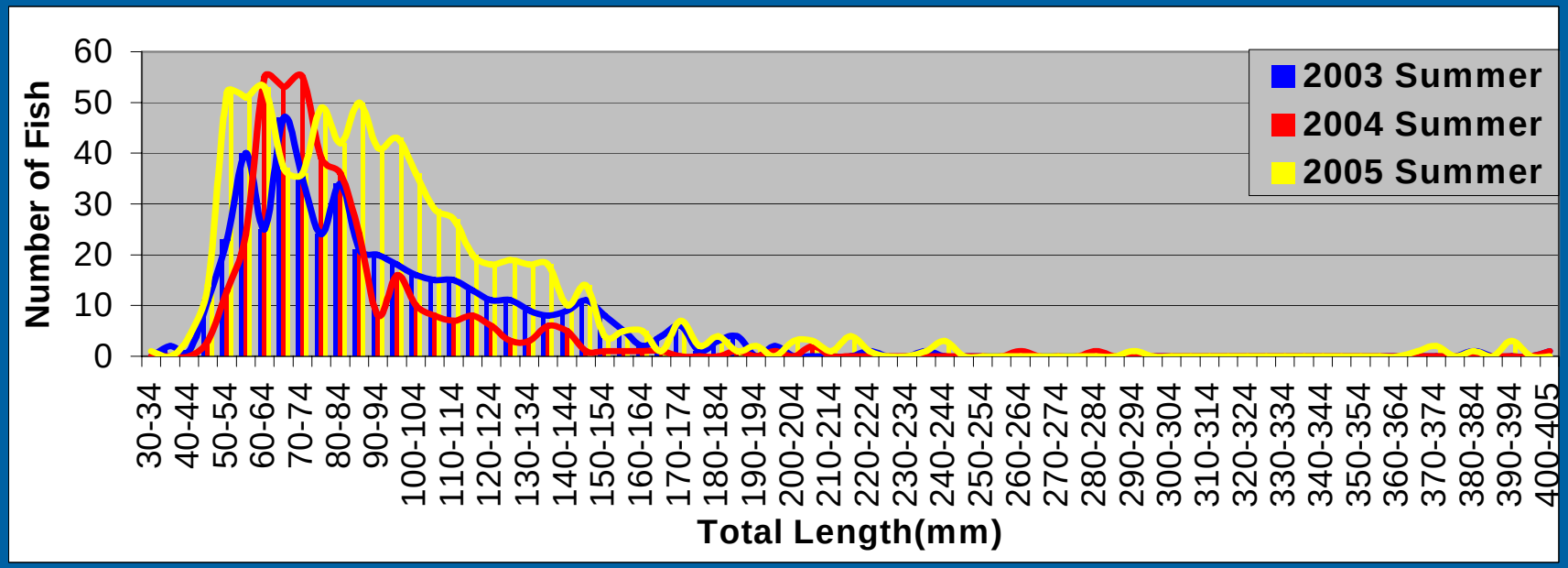
Hoopnet Catch Rate of Humpback Chub



Length Composition of Hoopnet Humpback Chub





Conclusions

- Non-native Removal Efficacy
  - Reduction of non-native catch composition proportion from ~95% to ~16%.
  - Persistent reduction of RBT to less than 10% of January 2003 abundance.
- Native Fish Response
  - Large increases in the electrofishing catch rate of native fishes.
  - Large increases in hoop net catch rate of juvenile native fishes.
  - Length composition suggests increases in HBC and FMS abundance include fish of age 1+ or increased growth rates.
- Warm-water Non-native Fish Response
  - Summer 2005 increase in catch rates of FHM, CRP, and bullheads.
  - Two striped bass, one smallmouth bass, and one green sunfish were captured during summer 2005.

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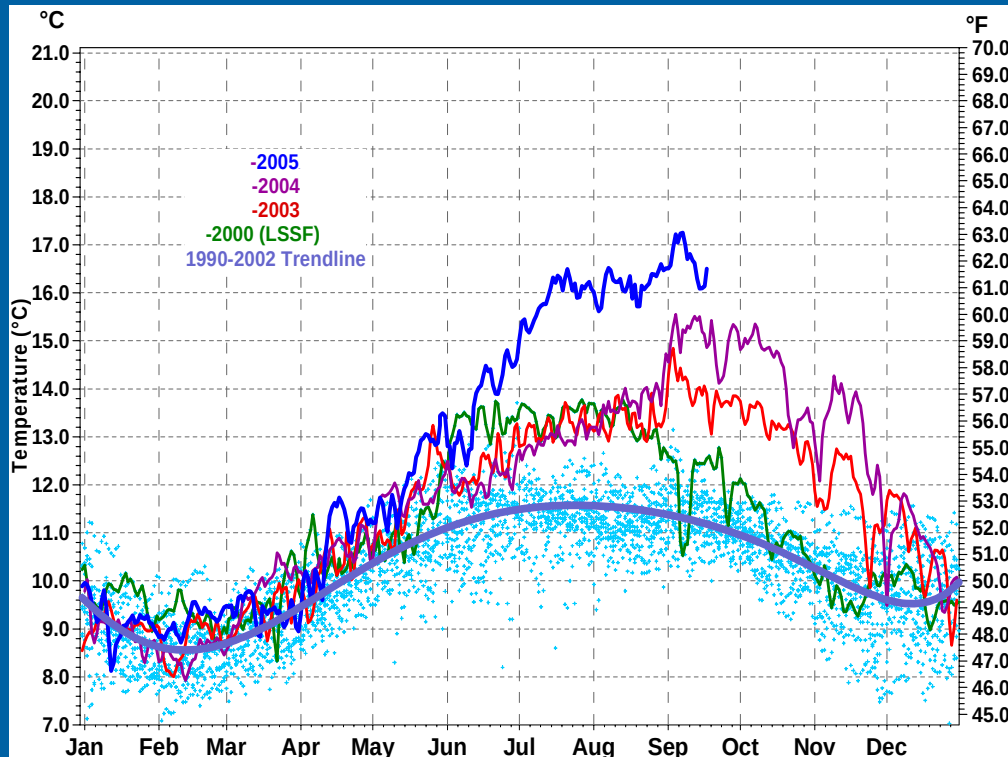
Uncertainties and Recommendations

- Observed patterns in native fish are extremely positive, need to wait and see.
  - No evidence that it is a result of Mechanical Removal
  - Confounded with temperature
- Decisions regarding continuation or not of mechanical removal should:
  - be made to provide maximum likelihood of resolving which factors (e.g. temp., non-native fish, and dam operations) most influence HBC population dynamics.
  - be made with full knowledge of whether or not thermal control of releases (TCD) will be available and when.

"You can count on mother nature to throw a monkey wrench in the best planned experimental design …"

Carl Walters ~ March 2000



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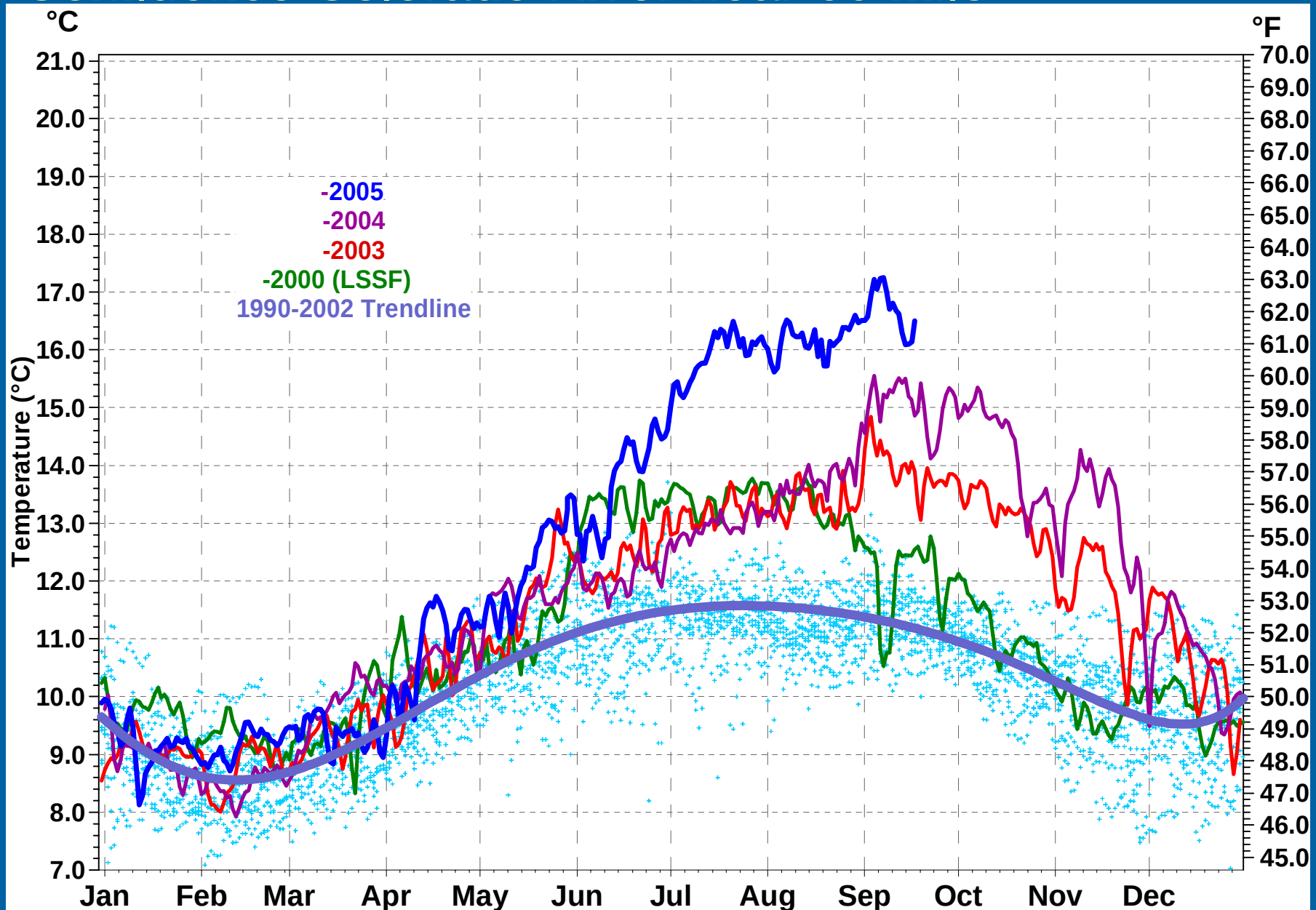
Mean Daily Temperatures above the LCR Confluence Colorado River near 60 mile