PROJECT STATUS REPORT

Development of microhabitat suitability criteria for fry and juvenile salmonids of the Trinity River

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EXECUTIVE SUMMARY

In 2003 and 2004, biologists from the Yurok Tribal Fisheries Program (YTFP) and the U.S. Fish and Wildlife Service (USFWS) collected fry and juvenile salmonid habitat suitability information on the Trinity River upstream of the confluence with the North Fork Trinity River. We performed direct observation via mask and snorkel in the spring of both years and recorded 1,470 observations totaling 9,147 fry and juvenile salmonids. Data for chinook salmon fry and juveniles 80 mm and less are sufficient for analysis. Data for coho salmon fry and juveniles and steelhead fry and juveniles are not sufficient for analysis.

METHODS

Habitat Survey

In the fall of 2002, we completed a comprehensive habitat survey of the Trinity River from Lewiston Dam to the North Fork Trinity River. Mesohabitat units were recorded as low slope, moderate slope, steep slope, run, pool, and backwater. They were numbered consecutively from Lewiston Dam and grouped under the following channel types; main stem, split channel or side channel. There were a total of 569 mesohabitat units identified. Length was measured with both a GPS unit and a laser range finder. Width was measured using a laser range finder. Depth was measured with a raft mounted fish finder and slope was measured with a clinometer. Additionally, pool tail depth, pool tail substrate and dominate and sub-dominate substrate were recorded. This survey made it possible for us to design a site selection process based on the mesohabitat composition of the Trinity River.

Site Selection

We separated the river into four reaches; Lewiston Dam to Rush Creek, Rush Creek to Douglas City Campground, Douglas City Campground to Dutch Creek, and Dutch Creek to the North Fork Trinity River. These reaches were chosen due to fry and juvenile production, the influence of tributaries, geomorphic changes to the riverbed and river access.

In 2003, mesohabitat units that were on government property were selected as potential research sites. These mesohabitat units were then assigned continuous numbers. For each stream reach, we randomly picked three mesohabitat units of each type for sampling. We also tried to sample a total of three mesohabitat types for the main stem, side channels, and split channels. In some instances, there were not three available or accessible. When this occurred, all were selected. Those units were then broken into top, middle and bottom by length and were also stratified by bank. We then sampled one 50 foot section in those units, randomly selecting between bank, and top, middle, and bottom.

In 2004, we randomly selected 50% (rounding up to the nearest whole number) of each habitat type (only in the two uppermost reaches) that were sampled in 2003. The resulting number was generally either one or two, depending on the amount of habitat units of each type in each reach that were sampled in 2003.

Next we queried a Microsoft Access* database (that had an ownership field assigned to each habitat unit) to sort those units that fell on government property for each habitat type in each reach. Then we reassigned those habitat units continuous numbers and used a random number list generated in Microsoft Excel* to make an ordered list of randomly selected sites to sample.

Then we added either one or two habitat units from the list described above to the randomly selected sites that were sampled in 2003 to get a minimum of three habitat units of each type in each reach. Next we sampled sites from this random list, above and beyond the minimum three, in proportion to their occurrence in each reach.

Side channel mesohabitat units were selected by first comparing the randomly selected main channel sites with aerial photographs overlaid with the habitat survey information. If the main channel site was adjacent to a side channel, we picked one habitat unit of the same type in the side channel to sample.

We split units that were 150 feet or greater into three sections of equal length into top, middle and bottom on both sides of the river. This made six discrete parts of habitat units that were 150 feet or greater. Then we selected four of these six randomly while keeping the selections paired i.e. 2 on each side of the river directly across from each other. Within these four randomly selected parcels, we sampled a portion that was 50 feet in length anywhere in the parcel that was representative of that parcel. When possible, we avoided sampling at the very start or end of habitat units, which can be transition areas into the next upstream or downstream habitat unit and are generally not representative of the unit itself. By sampling four 50 foot sections in the selected mesohabitat units, instead of one as was done in 2003, we reduced our traveling time between sample sites, and increased the rate at which observations were made.

For units that were 75-150 feet in length, we followed the above procedures except we sampled 25-foot portions instead of 50-foot portions. For units 50-75 feet in length we sampled two 50-foot portions directly across the river from each other (if the unit was 60 feet, the 50 foot parcel would start 5 feet from the upriver end of the unit and end 5 feet from the downriver end of the unit). If the unit was less than 50 feet, we sampled the entire unit.

Habitat Utilization

We made direct observations of fry and juvenile salmonids using mask and snorkel. This required at least two people; one to snorkel and one to record data. Snorkelers worked in an upstream direction, swimming from the bank out to just beyond the main "shear" or eddy line for the entire length of 50 feet. When undisturbed fish or fishes were located, a marker was placed at that location. Approximately 17 different variables were then either recorded and/or measured. These fields are listed in a datasheet that is attached to this document.

Juvenile and fry chinook salmon, coho salmon and steelhead were recorded according to the following size class categories:

Code	Size Class
1	40 mm and less
2	41 mm-50 mm
3	51 mm-80 mm
4	80 mm and greater

In 2003, no chinook salmon were recorded after the release of chinook salmon from Trinity River Hatchery. Although unmarked hatchery fish can generally be distinguished from their natural counterparts by an experienced diver, we erred on the side of caution. Furthermore, the effect of the hatchery releases on the behavior of natural chinook salmon is not known. In order to boost our sample sizes of chinook salmon and coho salmon in 2004, no observations of steelhead were made.

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* Mention of a trade name does not imply endorsement by the Yurok Tribal Fisheries Program or the U.S. Fish and Wildlife service

Velocities were measured with Price "AA" flow meters and depth was measured with a telescoping stadia rod. Total depth and depth of the fish (focal depth) were measured as the distance above the river bottom in feet. When a group of fish was encountered, the number of fish was recorded and the observation was made at the focal point of the cluster. If a group occupied more than one microhabitat, additional markers were dropped and a new observation was made to accurately describe the microhabitat(s) being utilized.

Additionally, stream margin edge type (SMET) of each 50 foot segment was recorded. Twelve different categories were used to describe the riparian area where the bank and the river met. These categories are listed on the attached datasheet. If it appeared that the stream edge was not homogenous, the 50 foot section was divided into as many as three different SMET units (generally not more than one or two). The snorkel time, bank slope, length, and snorkel width of each SMET was recorded.

Data Analysis

Frequency histograms of dominant and subdominant substrate, depth and velocity were constructed for size classes 1,2 and 3 of chinook salmon. There were not enough observations of size class 4 chinook salmon to warrant data analysis. Substrate observations were normalized to a value of 1.0. For depth and velocity, observations were not normalized as we have not yet developed any suitability curves.

RESULTS AND DISCUSSION

It is a concern that we may have inadvertently weighted our observations via our site selection process in 2004. Instead of picking an equal number of each mesohabitat type to sample, as was done in 2003, we sampled mesohabitat units in proportion to their occurrence in the river. This has the potential to artificially skew data. For instance, if 40% of mesohabitat types are pools, and one allocates 40% of sampling time to pools, this has the possibility of making the average depth of observations deeper than it would be otherwise because pools are deeper, in general, than other habitat units. However, if it is determined that this issue is a problem, it should be possible to correct the data by manipulation.

Table 1 summarizes the number of observations that we collected by species and size class, and the number of fish represented by those observations.

Table 1 Total number of observations by species and size class collected by direct observation on the Trinity River, California in 2003 and 2004, and the number of fish represented by those observations

	≤ 40 mm		41-50 mm		51-80 mm		> 80 mm		Total	Total
Species	Obs	Fish	Obs	Fish	Obs	Fish	Obs	Fish	obs	fish
Chinook salmon	318	2,863	506	3,799	346	1,869	13	20	1,183	8,551
Coho salmon	53	71	80	266	51	128	3	3	187	468
Steelhead	84	107	7	9	4	5	5	7	100	128
Total	455	3,041	593	4,074	401	2,002	21	30	1,470	9,147

Hydrographs and the duration of study in both years are provided in Figure 1. Sampling was not continuous throughout the study durations. We generally did not operate during times of ramp up and ramp down of the discharge at Lewiston Dam.

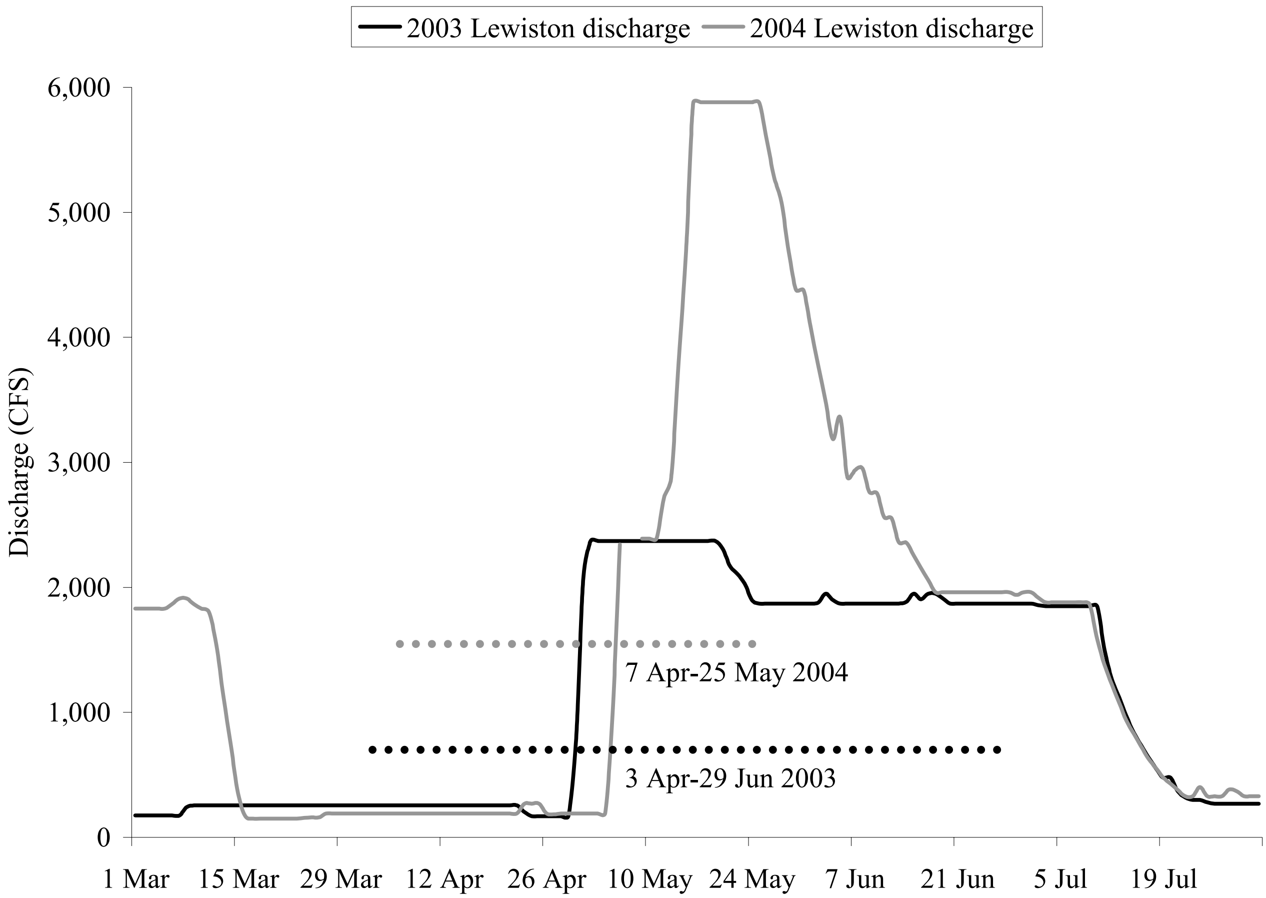

Figure 1 Lewiston Dam spillway discharge and habitat suitability criteria sampling duration (dotted lines) on the Trinity River, California, 2003 and 2004

In 2003, the majority of sampling took place at the roughly the 2000 cfs level with a few observations made at the base (~300 cfs) level. In 2004, most observations were made at base flows but some were made at the 6000 cfs level. At that level, snorkelers working in the confined channel near the hatchery observed all size classes and all species packed together in a strip of eddy along the bank no wider than 15 feet. One diver even witnessed active predation by larger salmonids on salmonid fry.

Figure 2 is habitat suitability indices for primary (dominant) and secondary (sub-dominant) substrate for size classes 1,2, and 3 of chinook salmon. Figures 3 and 4 are frequency histograms of the number of observations of chinook salmon size classes 1,2, and 3 for water column depth and water column velocity.

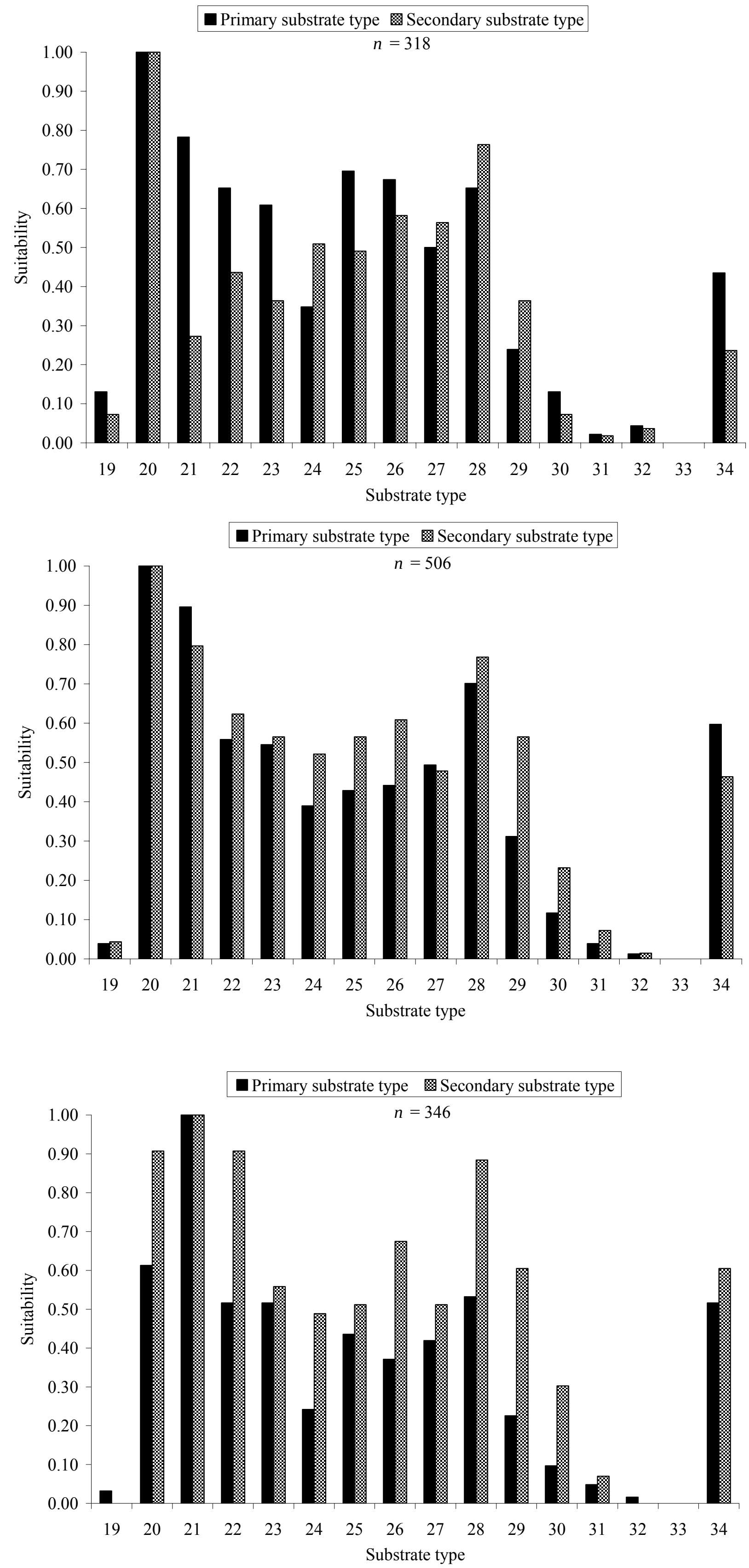

Figure 2 Habitat suitability indices for substrate utilized by chinook salmon ≤ 40 mm (top), 41-50 mm (middle) and 51-80 mm (bottom), in the upper Trinity River, California, 2003 and 2004

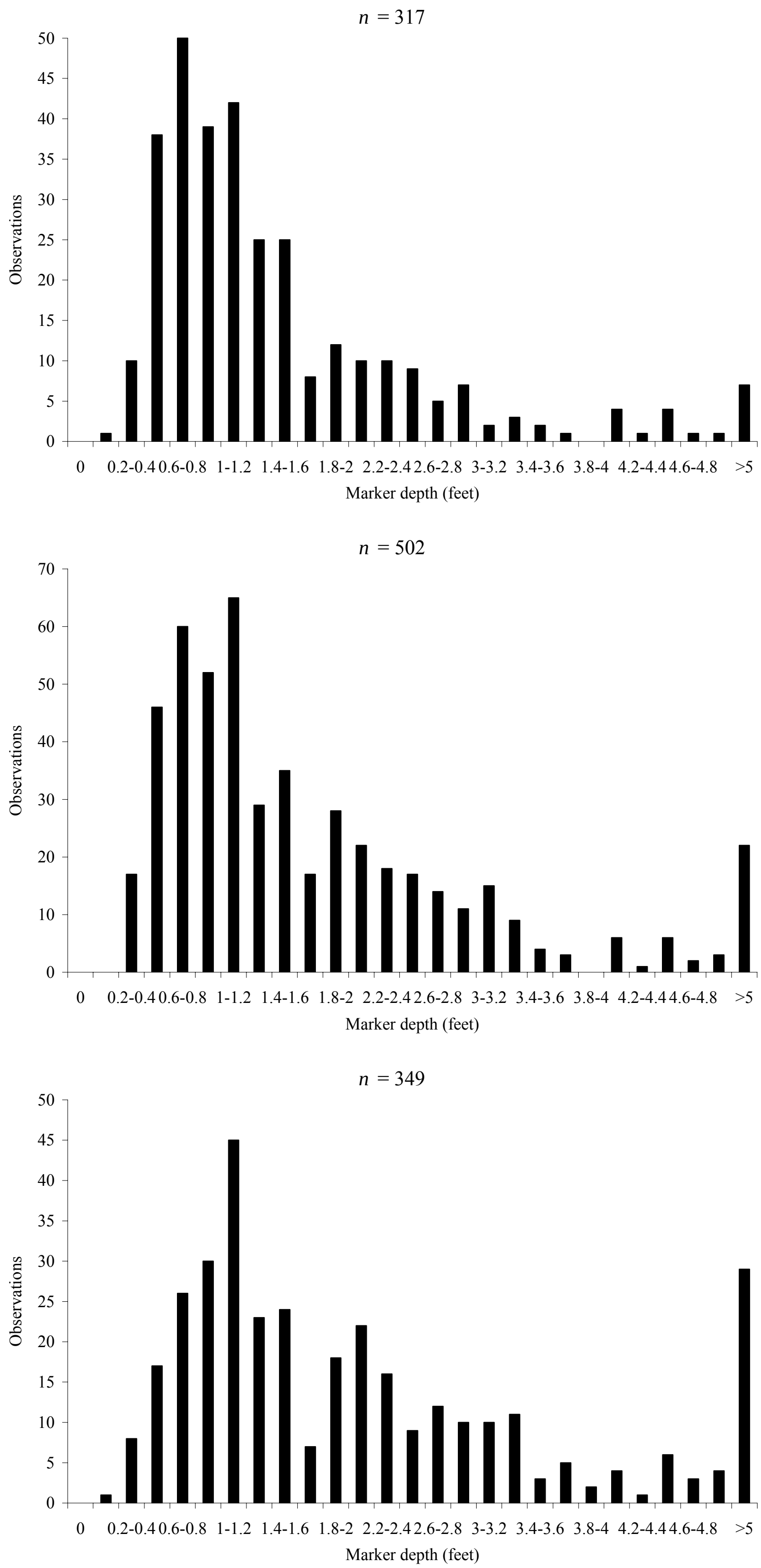

Figure 3 Frequency histograms for water column depth utilized by chinook salmon ≤ 40 mm (top), 41-50 mm (middle) and 51-80 mm (bottom), in the upper Trinity River, California, 2003 and 2004

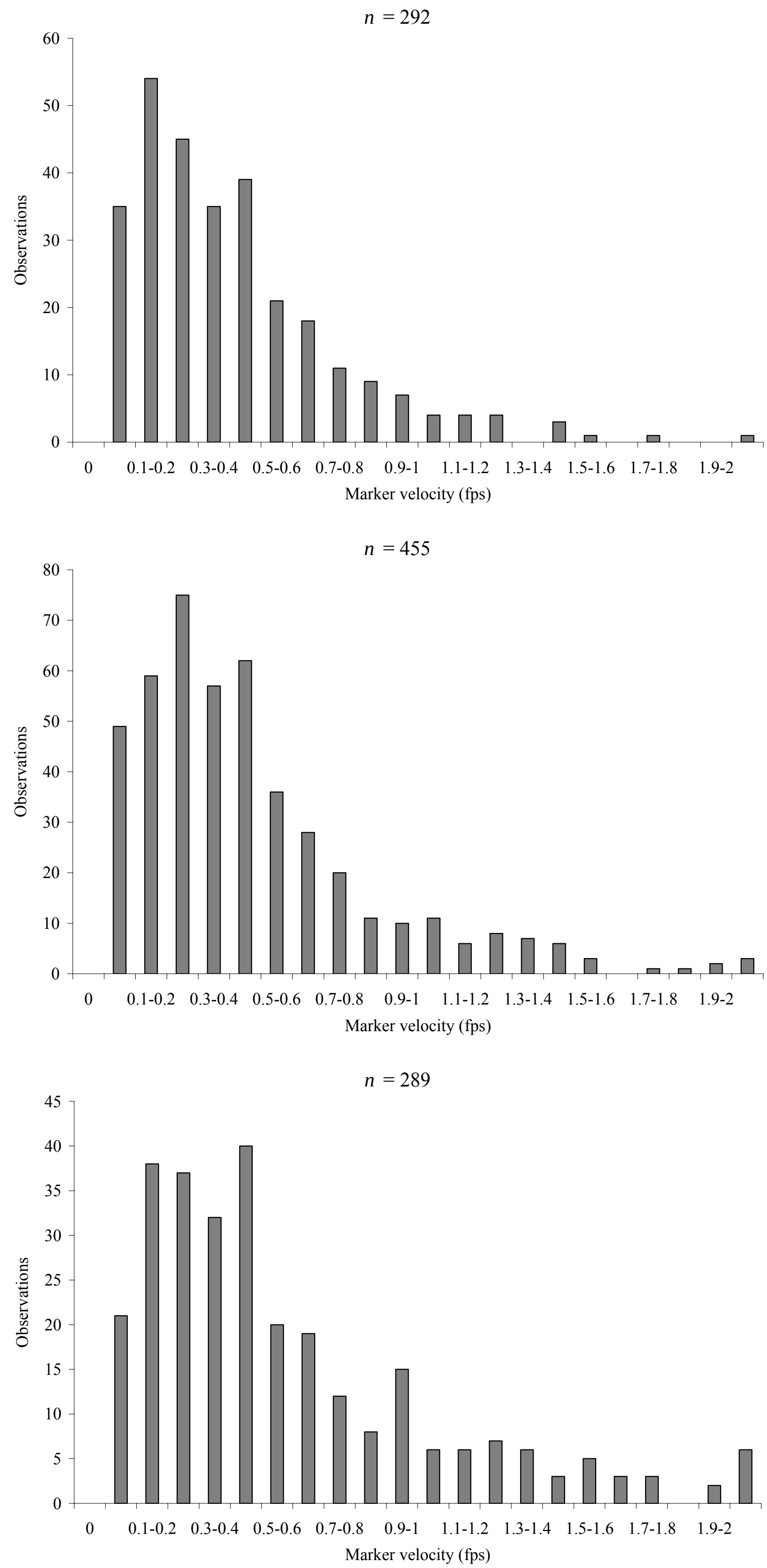

Figure 4 Frequency histograms for column velocity utilized by chinook salmon ≤ 40 mm (top), 41-50 mm (middle) and 51-80 mm (bottom), in the upper Trinity River, California, 2003 and 2004