

IMPLEMENTATION OF A MODIFIED SMALL STREAM JUVENILE
SALMONID SURVEY DESIGN

by

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IMPLEMENTATION OF A MODIFIED SURVEY DESIGN
TO ESTIMATE THE NUMBER OF JUVENILE
SALMONIDS IN SMALL STREAMS

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ABSTRACT

Several modifications to the Hankin and Reeves design (Hankin and Reeves, 1988; Dolloff et al., 1993) for estimating abundance of juvenile salmonids in small streams are proposed, field tested, and evaluated. Adaptive Sequential Independent Sampling replaces systematic sampling. The Method of Bounded Counts is utilized to calibrate dive counts when the first phase dive count is small (<20 fish), whereas electrofishing with removal method estimation is used at larger population sizes. In addition to shallow pools, riffles, and runs a slightly more complex habitat stratification includes (a) habitat that cannot be effectively sampled, such as cascades and shallow, unproductive riffles, and (b) a new Deep Pool stratum consisting of pool habitat that is too deep to electrofish. Direct observation is eliminated in riffles because previously gathered data (USDA Forest Service, unpublished) shows an inconsistent relationship between dive counts and subsequent removal method estimates in riffles.

The modified Hankin and Reeves design was applied in eight different streams during two summer field seasons for a total of 13 applications. Target species were 1+ trout (yearling and older cutthroat trout, *Oncorhynchus clarki*, and steelhead, *O. mykiss*, and 0+ (young of year) coho salmon, *O. kisutch*. I review problems encountered during field implementation of this modified survey design, I present quantitative results based on data collected from two summer seasons of field work, and I conclude with recommendations for minor changes that should improve upon proposed modifications. This modified protocol shows great promise for use with salmonid stocks listed under the Endangered Species Act of 1973.

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INTRODUCTION

Since the mid 1950's, direct observation of fish by snorkeling has been extensively used by fish biologists and researchers. Direct observation has been successfully used in studies of population size (Helfman 1983), fish habitat utilization (e.g., Thurow 1997, Helfman 1983), and fish behavior (e.g., Helfman 1983, Gibson 1978). Northcote and Wilkie (1963) used direct observation to estimate numbers of adults for several species of fish; Everest and Chapman (1972) used direct observation to determine micro-habitat requirements for juvenile steelhead and chinook salmon (*O. tshawytscha*) in Idaho streams; and Shirvell (1994) used direct observation to relate fish behavior to environmental variables such as flow.

Direct observation is affected by many environmental factors. Three environmental variables of greatest significance are water clarity, time of day, and water temperature. Water clarity (visibility) is probably the single most important factor affecting direct observation (Thurow 1994, Zubick and Fraley 1988, Schill and Griffith 1984, Helfman 1983, Fausch and White 1981, Whitworth and Schmidt 1980, Keenleyside 1962). Time of day that direct observation takes place determines the availability of light and thus influences the observations. Everest and Chapman (1972) limited direct observation to 1000-1400 h for ideal light conditions in June through August; Schill and Griffith (1984) used 1000-1530 h as the period of optimum light in July, August, and October; and Thurow and Schill (1996) used 1000-1600 h as the optimal light window in August. Water temperature can have a large impact on direct

observations of certain species. Gardiner (1984) found that the best direct observation results for salmonids took place at water temperatures greater than 15 °C. Gibson (1978) demonstrated that Atlantic salmon parr (*Salmo salar*) and juvenile brook trout (*Salvelinus fontinalis*) hide at temperatures below 10 °C. Hillman et al. (1992) showed significant undercounting of juvenile steelhead, coho salmon, and chinook salmon (as little as 20 percent of the true fish present were counted) at temperatures less than 9 °C.

Behavior of the species being observed also influences the effectiveness of direct observations. For example, Goldstein (1978) observed that the schooling behavior of large groups of cyprinids made them difficult to count and Hillman et al. (1992) found that divers generally counted less than 50 percent of the total fish present when fish were observed in groups of more than 40 fish. Use of cover by fish may also affect snorkel counts, and direct observation generally does not work well for cryptic benthic species which rely heavily on substrate for cover (Goldstein 1978).

Many published studies have compared counts of fish made via direct observation with other methods of population estimation (see Thurow and Schill 1996, Hayes and Baird 1994, Hillman et al. 1992, Rodgers et al. 1992, Zubick and Fraley 1988, Slaney and Martin 1987, Gardiner 1984, Griffith 1981, Goldstein 1978, for various examples of comparisons based on salmonids). Population estimates have generally been based on multiple pass removal methods (by electrofishing or seine), counts of dead fish following poison, or a variety of mark-recapture methods. Hayes and Baird (1994) compared single dive counts and single pass electrofishing counts to three pass removal method estimates to determine which of the two single pass methods would produce a good index of

relative abundance. Hillman et al. (1992) conducted single dive counts for juvenile steelhead, coho salmon, and chinook salmon, and compared those dive counts to numbers of fish collected following poisoning of stream reaches that had been counted. Rodgers et al. (1992) established closed habitat units and then stocked them with juvenile coho salmon to natural and above natural densities (based on surface areas of habitat units). They then compared single dive counts to two pass removal method estimates and mark-recapture estimates. Zubick and Fraley (1988) compared mark-recapture (angling), mark-recapture (snorkeling), and single dive counts for two sizes classes (>254 mm and <254 mm) of westslope cutthroat trout (*O. clarki lewisi*). Goldstein (1978) used repeated seine efforts to compare with single dive counts. Finally, Thurow and Schill (1996) compared the average of three dive counts against multiple pass removal method estimates for bull trout (*S. confluentus*). Griffith (1981) reported that single dive counts exceeded population estimates (by two percent); high dive counts were attributed to fish behaviors causing observers to count individual fish more than once. Most other studies have concluded that single dive counts underestimate true abundance (see Thurow 1994 for a partial summary). These comparisons are, however, misleading because a single dive count of fish can only provide an index of abundance and cannot be compared fairly with formal population estimates that are generated using formal mark-recapture or removal methods.

Hankin and Reeves (1988) showed that a combination of single dive counts and removal method estimates of abundance could be used to estimate juvenile salmonid abundance in small, clear-water streams based on a two-phase ratio estimation scheme.

This protocol quickly became established and is now widely used throughout the Pacific Northwest, and Southeastern United States. The protocol uses a large first phase sample drawn from a stratum of interest (e.g., pools) with fish counted in a single dive pass. Single dive counts are inexpensive and relatively quick, therefore a large number of habitat units can be sampled. A subset of these first phase units, the second phase sample, is then electrofished and a removal method estimator is used to estimate the "true" number of fish in each of these habitat units. The second phase ratio of the mean true number of fish to the mean dive count is used to correct or adjust the mean phase I dive count (Dolloff et al. 1993). The adjusted mean count per unit is then expanded up by the total number of units in the stratum. This method gives a nearly unbiased formal population estimate based primarily on dive counts.

Hankin and Reeves (1988) advocated using a simple habitat classification scheme that recognized just three habitat types: pools, riffles, and glides. Classification of habitat units using this simple scheme is faster than schemes with many habitat types (see Hawkins et al. 1993, Bisson et al. 1982, Flosi and Reynolds 1994, McCain et al. 1990), and is relatively unambiguous when compared to more detailed habitat classifications (Roper and Scarnecchia 1995).

In the original Hankin and Reeves (1988) survey design, first and second phase samples are selected using systematic sampling. A systematic selection interval, k , is chosen such that a desired sampling fraction ($1/k$) is achieved. Sample size is approximately fixed given known N (total number of units from which samples are drawn). Only the first unit selected (r) is random; all units selected thereafter are

predetermined according to the interval k , (i.e., given r , the selected units are: $r, r+k, r+2k, \dots$). Systematic unit selection allows the sample in each stratum (n_h) to be selected without previous knowledge of the total number of units in each stratum (N_h). Although systematic selection of units thus eliminates the need for a habitat map to be completed before selection of the phase I and phase II samples, prior knowledge of the units selected for each phase of sampling may introduce unknown observer bias. If r and k are known, then it is very easy for field personnel to have knowledge of which habitat units have been selected for each phase of sampling. It is conceivable that a diver would try to perform better in a particular habitat unit if he/she knew in advance that a unit had been selected for the phase II sample.

In this thesis, I report on the field implementation of several modifications to the original Hankin and Reeves (hereafter referred to as the modified Hankin and Reeves design) small stream survey design (Hankin, 1999). There are five principal modifications that are deemed important. First, habitat units are selected for phase I and phase II sampling using a modified Sequential Independent Sampling method termed Adaptive Sequential Independent Sampling (ASIS). Second, the Method of Bounded Counts (MBC) (Robson and Whitlock, 1964) is used as an alternative to electrofishing when unit population sizes are small. Third, a slightly more complex habitat stratification allows calculation of the proportion of habitat for which estimates of abundance are not possible. Fourth, dive counts in riffle habitat have been eliminated because previously collected data (USDA Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, Corvallis, OR) have not exhibited strong positive

correlations between single dive counts and removal method estimates in this habitat type. Finally, two phase General Regression Estimation (GRE; Sarndal et al. 1992, eq. 9.7.25) rather than ratio estimation is used to generate estimates of abundance based on collected survey data. In principle, these changes should improve the overall performance and cost-effectiveness of the original survey design.

MATERIALS AND METHODS

Field Protocols

During the summers of 1995 and 1996, 11 streams were utilized for various aspects of this study (Table 1). Three field crews conducted the different tasks associated with the modified Hankin and Reeves survey: (1) a habitat-typing crew of two persons classified the habitat and took habitat unit measurements as described below; (2) a diving crew of two persons conducted dive counts at the first and second phases of sampling; and (3) an electrofishing crew was used for removal method estimates in selected second phase units. The electrofishing crew was typically a four-man crew combining members of the habitat-typing and dive crews, and was augmented, as necessary, for unusually large habitat units.

Habitat Classification

Habitat units were classified into five strata: Shallow pools, riffles, runs, deep pools, and "Other". Complete implementation of the revised survey protocols is possible in shallow pools, riffles, and runs; an incomplete survey design may be used in deep pools. The Other stratum (consisting of side channels, cascades, and dry channels) does not allow for estimation of abundance.

Table 1. Summary information of the creeks visited for the various field components of this thesis in 1995 and 1996. In the Activities Column, S represents an abundance survey and T represents Time Trials (see text for description of the Time Trial experiments). The Length Surveyed column represents the primary channel length (m) for those creeks surveyed using the modified Hankin and Reeves survey protocol. Channel Order was derived from 7.5 minute USGS topographic maps.

Stream Name	State	Tributary to	Year(s)	Activities	Length Surveyed	Channel Order	Approximate Drainage Area
West Branch of Mill Crk	CA	Smith River	95	S	10,245	3	2,694 sq. ha ²
			96	S,T	11,103		
East Fork of Mill Crk	CA	Smith River	95	S	6,668	4	2,953 sq. ha ²
			96	S	6,508		
Bummer Lake Crk	CA	East Mill Ck.	95	S	1,102	3	1,373 sq. ha ²
			96	S	1,116		
South Fork of Schooner Crk	OR	Schooner Ck.	95	S	4,361	3	1,210 sq. ha ²
			96	S	4,262		
Ah-Pah Crk	CA	Klamath River	95	T	NA	3	1,243 sq. ha ²
North Fork of Schooner Crk	OR	Schooner Ck.	96	S	1,556	3	950 sq. ha ²
Canyon Crk	CA	Mad River	95	S	6,909	3	4,325 sq. ha ²
Wilson Crk	CA	Ocean	95	S	5,028	3	3,548 sq. ha ²
S Fork of the Winchuck R.	CA	Winchuck River	95	S	9,610	3	2,486 sq. ha ²
Clark's Crk	CA	Smith River	96	T	NA	2	
Prairie Crk	CA	Redwood Ck.	96	S	8,530	3	

Following Roper and Scarnecchia (1995), distinct habitat units had channel lengths longer than the average wetted widths. Segments of habitat that were not longer than the average wetted width, but were different than the previous downstream unit, were considered part of the next upstream unit (Roper and Scarnecchia 1995). For example, short riffle-like steps between pools were added to the overall length of the next upstream pool unit. When riffles were extremely long (well above average for the system being surveyed; often $\gg 40\text{m}$), these were broken into approximately 20m segments (which was a typical length, based on field observation, for riffles in the systems surveyed) to reduce the variability in riffle unit lengths; such breaks coincided with natural steps in the riffle as much as possible. Each riffle segment was then treated as a separate habitat unit, thus creating two or more consecutive riffles in a sequence of habitat units.

Unit breaks were defined as distinct geomorphic channel breaks (Hawkins et al. 1993), except in the case of very long riffles. These breaks work as natural retaining features for fish and should generally keep fish from leaving a particular habitat unit if disturbed by a diver.

Shallow pools were defined as any scoured habitat unit with slow currents (Hawkins et al. 1993, Bisson et al. 1982), little surface agitation, and a maximum depth less than 1.1m. These units are often not very complex (i.e., lacking extreme complexity due to wood, substrate, undercut banks, etc.) and, if fish numbers are low, and stream substrate is relatively silt-free, MBC (see below) could be successfully applied as a calibration technique. When fish numbers were high, shallow pool units could be

electrofished effectively. The 1.1 m maximum depth criteria for shallow pools was based on Hayes and Baird (1994) and Gardiner (1984) who found that electrofishing was only effective in shallow water.

Riffles were defined as any habitat unit that had shallow, fast-flowing water with surface agitation and substrate breaking the surface (Bisson et al. 1982, McCain et al. 1990), and was also too shallow to dive. Electrofishing removal estimates were made in a single first phase ASIS sample of these units. No dive counts were made in riffle habitat units.

Definitions and classification of runs varied slightly between years. In 1995, a run was considered as swift water with some surface agitation and few occurrences of substrate breaking the surface (McCain et al. 1990), but with sufficient depth for dive counts as determined by the habitat-typer. For 1996, runs were limited to any swift water with some surface agitation and few occurrences of substrate breaking the surface, but with depth of at least 40 cm for more than approximately 80 percent of the wetted unit area. In 1996, shallower run-like water was considered riffle habitat because it could be more effectively sampled by electrofishing than by diving.

In 1995 and 1996, deep pools were defined as pools that were (a) too deep to electrofish (>1.1 m), or (b) too complex to allow valid use of MBC. Examples of complexity include log jams, deep undercut banks, or any other structures that seriously impairs the visual field of the divers.

Other habitat units encountered in surveys included side channels, cascades, and dry channels. Fish abundance could not be estimated in these habitat units, but a

complete habitat map included measurements of such units. Side Channels were entire single channels of a split flow in which the habitat units were deemed too small for snorkel survey work. These channels were treated as single units with total length, widths (top and bottom), and maximum depth recorded. Cascades were defined as high gradient riffles, bedrock chutes, or waterfalls (see High Gradient Riffles and Cascades, McCain et al. 1990). Finally, Dry Channels were defined as any length of channel with no surface flow at the time of the survey. Only length was recorded for dry channel units.

Two distinct situations arose with respect to split flows (multiple channels):

1. A channel had sufficient flow so that the individual habitat units within the channel were deep enough to snorkel. In these situations, the habitat-typing crew would survey each channel according to rules given below; *or*
2. A channel did not have sufficient flow for the units within the channel to be deep enough to dive. In this case, the entire channel was classified as a Side Channel.

Channels were surveyed in descending order based on flow: the largest water volume channel was surveyed first, followed by the second largest water volume channel, and so on. Channels that had 100 percent flow were assigned a channel code of 0, whereas channels with less than 100 percent flow were assigned channel codes of 1, 2, 3, 4,... in order of descending flow (Figure 1). This technique allowed for sampling and subsequent enumeration of salmonid abundance in multiple parallel channels. Each channel was assigned a percent flow value, based on a visual estimate made by the percent. Individual units in which channels converged/diverged were associated with the

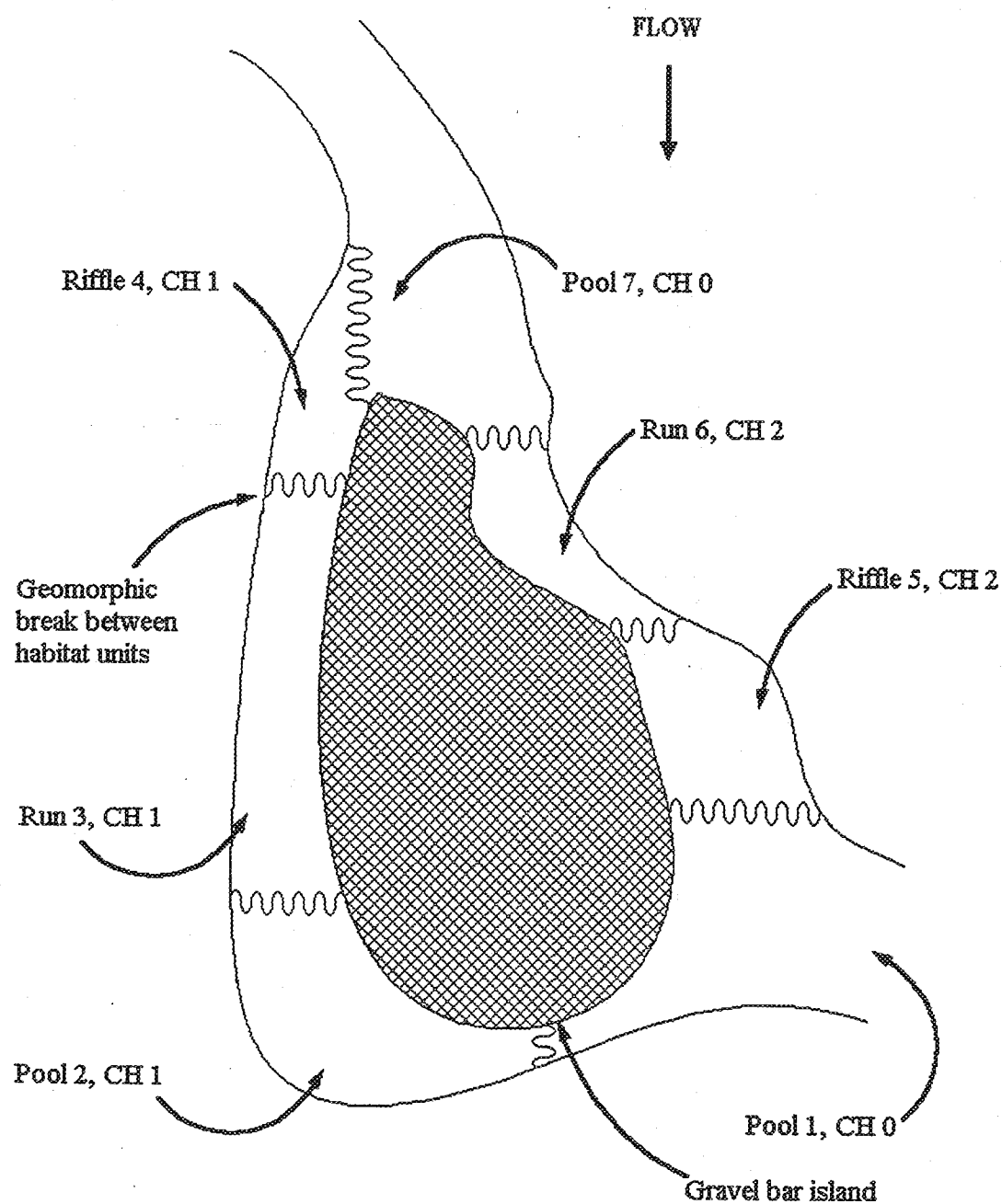


Figure 1. A typical split flow encountered during habitat-typing demonstrating both the unit number system and the Channel Code (CH) system. Figure by Chris Moyer.

next lower ranking channel code. If a channel had distinct units that were not riffle habitat, and the units were reasonable to dive, then the units were habitat-typed using unit definitions previously described. Otherwise, if the units were not riffles but were unsuitable for diving (too small and/or shallow), then the entire channel was treated as a single Side Channel unit. If the channel had only riffle habitat for its entire length, then the channel was treated as a riffle unit and included with other riffles for possible electrofishing..

Habitat units were numbered sequentially depending on the direction of travel by the habitat typing crew. If the crew was traveling upstream (most common), unit numbering began with one and increased sequentially (1, 2, 3,..., N) until the end of the survey. If the crew was traveling downstream, then numbering began with some arbitrary number, say 500, that was greater than the total estimated number of units. Numbering then decreased sequentially (500, 499, 498,...) until the end of the survey.

For each habitat unit, the habitat crew recorded measurements of approximate thalweg length, width at the upstream and downstream end of the habitat unit, and maximum depth. Width and depth measurements were taken with a stadia rod, whereas thalweg length was taken with a hip chain. Width measurements were taken perpendicular to the flow as it entered or left the habitat unit rather than perpendicular to the channel width (Figure 2). Unit areas were calculated as the product of the thalweg length and the average wetted width at the top and bottom of the unit. Measurements were usually taken after classification of the habitat type. If the habitat-typer could not reliably detect whether or not the maximum depth of a habitat unit exceeded 1.1m,

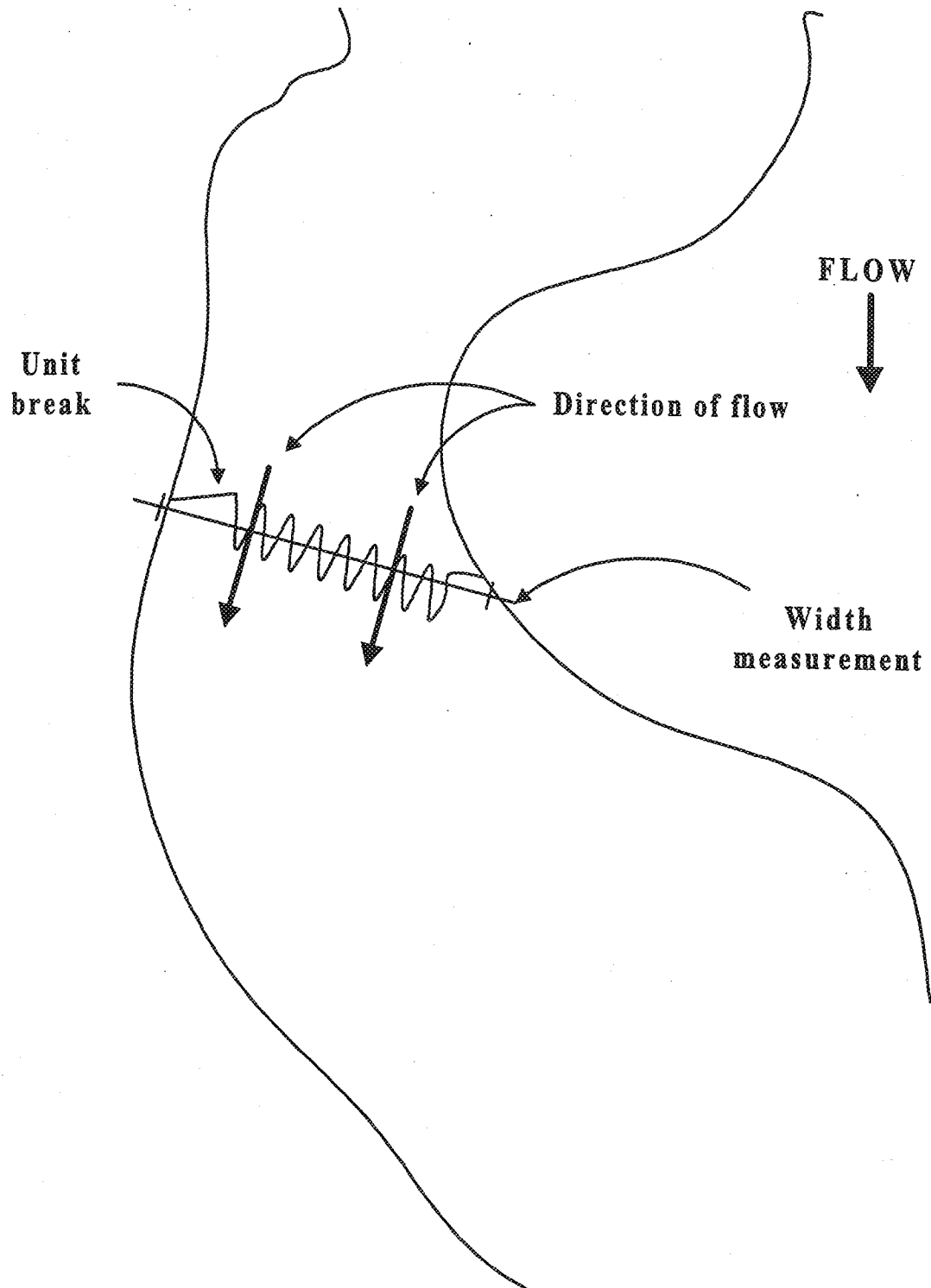


Figure 2. Demonstration of how width measurements were taken perpendicular to the flow rather than perpendicular to the wetted width. Figure by Chris Moyer

however, then depth was measured before classification to allow separation of deep pools from shallow pools.

After a unit was classified, an Adaptive Sequential Independent Sampling (ASIS, see below) tag was drawn, if appropriate to determine whether a unit was to be included in the first phase sample. If a unit was selected for phase I sampling, then plastic flags were hung at the top and bottom unit breaks. On the flags were recorded the position of the flag (top or bottom of the unit), the unit number, and the action to be taken (diving for shallow pools, runs, and deep pools; electrofishing for riffles).

Phase I and Phase II Sample Selection

ASIS is a Sequential Independent Sampling (SIS) algorithm that has been modified so that it alters the individual unit selection probabilities to reduce the variation in sample sizes within strata (Hankin, 1999.). Simulations (Hankin, 1999) have shown that ASIS generates first and second order inclusion probabilities that are very similar to simple random sampling inclusion probabilities. In ASIS, the probability of selecting unit i depends on both a basic sampling rate (e.g., one in three pools) and on the number of units that have been drawn from the first $(i-1)$ units. If the number of units selected for the first $(i-1)$ units is less than the expected number, then the unit selection probability exceeds the basic sampling rate. If instead the number of units selected from the first $(i-1)$ units is greater than the expected number of units, then the unit selection probability is revised downward to less than the basic sampling rate.

Phase I sampling rates, p_1 , were set at one in three for the shallow pool, run, and deep pool strata. Phase II sampling rates, p_2 , were set at one in four of the phase I sample

of shallow pools and runs. For riffles, the single phase sampling rate was set at one in twelve units, equal to p_1p_2 . Only single diver counts were made in deep pools during 1995, but in 1996, three independent diver counts made in each selected deep pool.

ASIS algorithm output was in the form of a 21.6 by 27.9cm sheet of paper with fourteen columns of binary output: (1's and 0's) with 1's indicating unit selection. Columns were in sequential order, and thus would be connected "foot to head", (i.e., the head of column three was attached to the foot of column two to ensure correctness of sequence). Each sheet was cut into strips approximately 1.3cm wide. Strips were then glued together to form a single strip. These strips were then rolled up (as a roll of stamps) and placed in a container intended to hide future unit selections from the divers and habitat-typer, as well as to dispense the strips. The dispensing container was a film canister with a single slit cut in the side. Two rolls were placed in each container with a separator of washers cut from other film canister lids. The strips were then fed through the slot allowing one ASIS "position" to be exposed at a time as required by the habitat-typer or diver. The habitat crew carried two canisters each containing two phase I strips, one strip each for shallow pools, runs, riffles, and deep pools. The dive crew carried one canister containing two phase II strips: one strip each for shallow pools and runs.

Diving Procedures

The set of rules described below were followed by a two person diving crew. Diving (snorkeling) was generally limited to the hours between 0900 and 1500. Occasionally (due to scheduling issues), diving took place outside of this optimum window. Diving was always conducted from the downstream break of a habitat unit to

the upstream break of the habitat unit. When diving a unit, the diver methodically searched for and tallied all fish of the target species observed.

After the first dive pass was completed in phase I units, an ASIS tag was pulled to determine if a specific habitat unit would be selected for phase II sampling. If a unit was selected for phase II sampling, then depending on the results of the phase I sample, one of the following two methods was used for calibration. If the count of 0+ coho salmon or 1+ and older trout exceeded 20 fish (for either species) on the first dive pass, and the unit was selected for phase II sampling, then the second phase sample was via electrofishing. If the counts were less than or equal to 20 or 30 fish for 1995 and 1996, respectively, each for both species counted on the first dive pass, then the phase II sample was via MBC (i.e., two additional dive counts were conducted immediately—no delay between dive passes unless siltation was an issue—after the first dive pass). After all diving was completed at a particular habitat unit, all flagging was removed unless a phase II unit was to be electrofished, in which case the flags were left for identification of the units at a later date.

As the divers progressed upstream, they "leap-frogged" each other in relative position. The downstream diver traveled upstream to the same position as the upstream diver and then moved upstream to the next habitat unit flagged for diving. When the downstream diver passed the upstream diver on the stream reach being surveyed, he/she acquired the ASIS canister and carried it to the next upstream dive unit. Thus the ASIS canister was always with the diver farthest upstream.

Juvenile coho salmon (age 0+), hatched during the spring of the year in which the survey was conducted, were generally the target species. These young-of-year could usually be unambiguously distinguished from 1+ coho salmon. When a diver encountered a fish of sufficiently large size that identification of year class was ambiguous, it was recorded as a 1+ coho salmon. This was a judgement call in the field, as no juvenile coho salmon were sacrificed to be aged with appropriate laboratory techniques.

Young of year chinook salmon were not a target species, but were recorded whenever encountered. These were chinook salmon that hatched during the spring of the year in which the survey was conducted but had not yet left the stream.

A trout category included both cutthroat trout and steelhead because divers could not reliably separate small specimens of these two species underwater. Trout less than approximately 85 mm fork length were not counted in surveys. This fork length was used to distinguish between 0+ trout, and 1+ trout and older. As summer progressed the distinction between 0+ and 1+ and older trout became less clear.

With rare exception, delays between habitat-typing and dive counts were no more than 2 d maximum. When diving and habitat-typing were conducted on the same day, the dive crew did not begin its work until at least 1 h after the habitat-typing crew had started.

Second Phase Calibrations Methods

Electrofishing. Before electrofishing a habitat unit, block nets (4-6 mm mesh size) were placed completely across the wetted channel at the lower and upper habitat

unit breaks. The lower net was placed first to prevent any downstream emigration caused by disrupting fish in the habitat unit during the process of setting up the nets. Once the bottom of the lower net was secured with rocks and solidly supported, the top net was placed. Care in deployment of block nets helped ensure the assumption of a closed population that is required for valid removal method estimation.

Three electrofishing passes were conducted starting at the top net and working downstream to the lower net, systematically electrofishing and removing captured fish from the unit. Numbers of fish captured (as identified by size and species) and electrofishing times were recorded separately for each pass. Each pass was conducted for approximately the same length of elapsed time that the electrofishing unit was on (as recorded by the built-in timer on the electrofisher unit) to equalize effort on each pass. Abundance, $\tilde{y}_i$, was estimated using the Moran-Zippin removal method estimator (Seber, 1982). When the MLE failed, $\tilde{y}_i$ was set equal to the sum of catches on the three passes, a minimum estimate of true abundance.

Repeated Dive Counts. When MBC was used for calibration, two more dive passes were conducted in the same fashion as the first dive pass. Based on preliminary field work we waited five minutes between completed dive passes when the first dive pass took less than five minutes. If a unit required more than five minutes to dive then a diver could proceed with the next dive pass without waiting. We assumed that these practices allowed the fish to return to pre-disturbance distribution and behaviors.

When repeated dive counts were used to estimate the numbers of fish present in second phase units, the Bounded Counts estimator was used (Robson and Whitlock 1964):

$$\tilde{y}_i = D_{\max} + (D_{\max} - D_{\max-1}),$$

where $D_{\max}$ and $D_{\max-1}$ represent the highest and second highest dive counts, respectively, in unit i .

Abundance Estimation

General Regression Estimation (GRE) was used to calculate stratum specific abundance estimates (Hankin 1999, equation 1a):

$$\hat{Y} = \frac{N}{n_1} \sum_{s_1} \hat{y}_i$$

where N is the total number of habitat units for the stratum of interest; n_1 is the number of units selected from that stratum in phase I; s_1 denotes summation over the phase I sample; $\hat{y}_i$ is a regression estimate of the number of fish present in unit i in the phase I sample;

Numbers of fish present in phase I units were calculated using:

$$\hat{y}_i = \hat{a} + \hat{b}x_i;$$

$$\hat{a} = \bar{y} - \hat{b}\bar{x};$$

$$\hat{b} = \frac{\sum_{s_2} (\tilde{y}_i - \bar{y})(x_i - \bar{x})}{\sum_{s_2} (x_i - \bar{x})^2};$$

$$\bar{y} = \frac{1}{n_2} \sum_{s_2} \tilde{y}_i; \bar{x} = \frac{1}{n_2} \sum_{s_2} x_i$$

where n_2 is sample size for phase II, s_2 denotes the phase II sample, x_i are the single dive counts, and $\tilde{y}_i$ are MBC or removal method estimates of abundance for phase II units.

The sampling variance of the estimated total in a given stratum was calculated as (Hankin, 1999, equation (2)):

$$\hat{V}(\hat{Y}) \approx N^2 \left(1 - \frac{n_1}{N}\right) \frac{s_y^2}{n_1} + N^2 \left(1 - \frac{n_2}{n_1}\right) \frac{s_d^2}{n_2}$$

where

$$s_y^2 = \sum_{s_1} \frac{(\tilde{y}_i - \bar{y})^2}{n_2 - 1}, \text{ and } s_d^2 = \sum_{s_2} \frac{(\tilde{y}_i - \hat{y}_i)^2}{n_2 - 1}$$

An estimate of the total population numbers across more than one sampled stratum can be calculated by summing the individual stratum estimates. An estimate of sampling variance for the estimated total population is calculated in the same fashion.

Approximate 95 percent confidence intervals were formed by:

$$\hat{Y} \pm t_{n-1} \sqrt{\hat{V}(\hat{Y})}$$

Time Trials

In 1995 and 1996, time trials were carried out in three different streams to test the effect of the delay between repeated dive passes on the variability of the dive counts. In 1995, repeated dive counts were made in Ah-Pah Creek, a tributary to the lower mainstem Klamath River. In 1996, repeated dive counts were made in Clark's Creek and West Branch Mill Creek, tributaries to the lower mainstem Smith River, which flow through Jedediah Smith State Park. All three of these creeks were selected because of the current logistics.

In each stream, as many shallow pools upstream from a purposively selected location, as there were resources to sample in a single day were selected. In Ah-Pah Creek, three divers each dove seven shallow pools at each of three time intervals (21 pools). In Clark's Creek, two divers, each dove six shallow pools at each of three time intervals (11 pools). In West Branch of Mill Creek, there were three divers: two divers dove six shallow pools each at each of three time intervals (12 pools), and one diver dove eight shallow pools at each of three time intervals. All told, over two years and three creeks, there were fifty-three shallow pools in which three sets of three repeated dive counts, one set for each time interval, were made by the same diver (Table 2).

Each set of three repeated dive counts consisted of three dive passes carried out using one of three time intervals. A time interval was defined as the length of time between successive dive passes measured *after* the diver has returned to the downstream end of the habitat unit. The three time intervals tested were 0 min (immediate return to the water), 5 min, and 15 min. For the first day, the time interval was randomly assigned to the habitat unit. On subsequent days, the time interval was the next interval in the series 0, 5, and 15. For example, if on day one the randomly assigned interval was 15 min, then on day two the interval would be 0 min, and on day three the interval was 5 min. Divers recorded the time it took to conduct a given dive pass, the time it took to walk to the downstream end of the unit, and the time interval assigned for that unit on that day. Length and depth measurements were also taken on each pool selected for the time trials.

Table 2. Dates, divers, and units snorkeled for each creek in which time trials were conducted. Units in sequence refers to the sequence of shallow pool habitat units in each creek. Units not accounted for by sequence were skipped due to complexity.

Creek	Dates	Name of Diver	Number of Units	Units in Sequence
Ah-Pah Crk	24-26 Oct 1995	Hank B	7	1, 2, 7, 11, 14, 16, 20
		Gino S	7	3, 5, 9, 12, 15, 18, 19
		Chris M	7	4, 6, 8, 10, 13, 17, 21
Clark's Crk	5-7 Jun 1996	Greg T	6	4, 6, 9, 11, 13, 16
		Mike C	6	5, 7, 10, 12, 15, 18
West Branch Mill Crk	11-13 Jun 1996	Mike C	6	1, 4, 7, 10, 13, 16
		James R	8	2, 5, 8, 11, 14, 17, 20, 23
		Tim H	6	3, 6, 9, 12, 15, 18

Preliminary analysis of time trial data collected after the 1995 and prior to the 1996 surveys suggested that there was no effect of time intervals on dive counts (see Results). Therefore, all calibration dives in 1996 were conducted with little or no wait between dive passes. The only exception to this was when sediment disturbed by the diver on previous passes reduced visibility. In such instances, the length of time to wait was based on the discretion of the diver.

Two different approaches were used to analyze dive count data for the time trial experiment. First, simple means and variances of both dive counts by time interval/dive pass combination and of MBC estimates by time interval were calculated and compared using paired t-tests. Second, a Generalized Linear Model (GLM) was developed and analyzed using S-PLUS software (ver. 4.5, MathSoft).

For the GLM analysis, the response variable was estimated observation probability. For *each* time interval/species combination, observation probability was estimated as either (a) the dive count divided by the MBC estimate of abundance for that day, or (b) the dive count divided by the MBC estimate of abundance as calculated for each unit using the data from all three days. In other words, the first set of observation probabilities were calculated using the data from each day for each species/age-class combination, while the second set was calculated from the dive counts pooled from all three days. (These estimates of observation probability have substantial positive bias (Hankin, 1999) because the MBC estimate is generally negatively biased.)

Estimated observation probabilities were modeled as a linear function of creek, time interval, pass number, a date/unit number interaction, and interval/pass number

interaction assuming a binomial probability model with a logit link. The following terms were treated as factors: creek, INTORDER (the order of the three days in which the dive passes were conducted), pre-dive interval (pdi, coding for the time interval), nDIVE (coding for the dive pass number), and first (coding for the first dive pass versus the remaining two dive passes). There was not enough replication to split the date/unit number interaction. COUNT was the dive count for *each* time interval/dive pass number/species combination, while MBC is the unit population estimate generated by MBC for *each* time interval/species combination. The first dive pass was not impacted by a previous dive pass or the time interval, so it was considered separately from the other dive passes by coding. A contrast structure was developed that allowed for detection of effects to determine (a) if the first dive pass had an effect, (b) if the time interval had an effect, (c) if the second and third dive passes had an effect, and (d) if the time interval and pass number interaction had an effect. GLM model fitting weights were assumed equal to the MBC estimates of abundance (for *each* time interval/species combination), and GLM's were run separately for each species. The following S-PLUS code was used for the 0+ coho model:

```
glm(formula=(COUNT/MBC) ~ I(0^first) + factor(CREEK) + factor(DATE) +
factor(first):pdi + factor(first):nDIVE + factor(first):pdi:nDIVE, family =
binomial, data = fish[fish$SPP == "COHO",], weights = BC.hard)
```

The model for 1+ trout was identical except for the following code:

```
data = fish[fish$SPP == "TROUT",].
```

After the GLM analysis, comparisons were made of the average daily estimated observation probabilities for each species/age-class/creek combination using a Tukey-Cramer MCP. The pairwise overall alpha rate was calculated according to Stevens (1992).

RESULTS

1996 West Branch Mill Creek Survey

Abundance estimation results for the 1996 West Branch of Mill Creek survey are presented below for illustrative purposes because both methods of calibration (electrofishing and MBC) were used during the course of this survey. Abundance surveys in other streams or years. Further, densities are presented in fish per meter rather than fish per square meter due to the inconsistent relationship between fish and area.

Habitat Mapping

A total stream length of approximately 11,103 m of primary channel (channel codes of 0 and 1) was surveyed on the West Branch of Mill Creek during 1996 (Table 3). Of that, shallow pools and deep pools accounted for 44% of the total habitat units, while fast water units (runs and riffles) accounted for approximately 55% of the habitat units surveyed (the other category accounted for the remaining 1%; Table 3). Shallow pools, deep pools, runs, riffles, and other (cascades and side channels combined) comprised 33.7%, 14.9%, 10.9%, 40.0%, and 0.5% of the total habitat unit lengths, as compared to 35.3%, 15.7%, 11.1%, 37.6%, and 0.3% of the total habitat area (Table 3). Fast water and slow water account for 49% and 51% of the total surface area, respectively.

Abundance Estimation

Based on application of the modified Hankin and Reeves survey design, stratum specific population estimates and confidence intervals ($\pm$, in parentheses) for 0+ coho

Table 3. Summary habitat information from the West Branch of Mill Creek survey conducted in June and July, 1996. Based on *primary* channel length (channel codes 0 and 1 only).

Habitat Type	Number of Units	Total Length (m)	Area (m ²)
Deep Pool	45	1,658	9,262
Shallow Pool	139	3,743	20,800
Run	50	1,215	6,512
Riffle	178	4,436	22,151
Other	4	50	162
Total	416	11,103	58,889

salmon for the West Branch of Mill Creek in 1996 were approximately 3,600 (± 749), 1,870 (± 615), and 1,300 ($\pm 1,193$) fish, respectively, for shallow pools, riffles, and runs (Table 4). Ninety-five percent confidence intervals represented 21, 33, and 89 percent of the stratum-specific population estimates for shallow pools, riffles, and runs, respectively. Population estimates and confidence intervals ($\pm$, in parentheses) for 1+ trout were approximately 1,600 (± 765), 560 (± 56), and 415 (± 396) fish, respectively, for shallow pools, riffles, and runs, respectively. The 95 percent confidence intervals were 48, 10, and 96 percent of the stratum-specific population estimates for shallow pools, riffles, and runs, respectively.

Correlations between phase I dive counts and phase II estimates were calculated based on five runs (two estimates from electrofishing, three from repeat dive counts) and 12 shallow pools (four estimates from electrofishing and eight from repeat dive counts). For 0+ coho salmon, phase I dive counts were highly correlated with the phase II estimates of fish numbers: correlations were 0.992 and 0.932 for runs and shallow pools, respectively (Table 4). Correlations for the calibrated Deep Pool stratum (for 0+ coho salmon and for 1+ trout) were larger (Table 4), but interpretation is complicated by the negative bias of MBC estimates for this stratum. Correlations between phase I and phase II abundance estimates were lower for 1+ trout: 0.852 and 0.632 for runs and shallow pools, respectively.

Table 4. Summary of the 1996 West Branch Mill Creek population estimate data. Correlations between the phase I dive counts and the phase II unit population estimates are given by r . Stratum length represents the sum of the *total* channel lengths for each stratum.

Species	Habitat	N_h	Sample Size		r	$\hat{Y}$	$SE(\hat{Y})$	Stratum Length (m)	Fish/m
			phase I	phase II					
0+ coho salmon	Shallow Pools	141	48	12	0.932	3,605	379	3,682	0.98
	Riffles	183	17	NA	NA	1,872	311	4,338	0.43
	Runs	50	17	5	0.992	1,346	836	1,165	1.15
	Deep Pools ^a	45	15	15	0.982	2,724	307	1,643	1.66
TOTAL						9,547	829	10,828	0.88
1+ trout	Shallow Pools	141	48	12	0.623	1,587	387	3,682	0.43
	Riffles	183	17	NA	NA	560	28	4,338	0.13
	Runs	50	17	5	0.852	414	197	1,165	0.17
	Deep Pools ^a	45	15	15	0.977	681	105	1,643	0.41
TOTAL						3,242	447	10,828	0.30

^a This estimate may have substantial negative bias resulting from the use of the MBC estimator at large population size.

Surveys in Other Streams

Realized ASIS Sample Sizes

ASIS was used as the sample selection method in all thirteen surveys conducted in 1995 and 1996. With a single exception (Prairie Creek), target unit selection rates were 1/3 for phase I and 1/4 for phase II. Realized phase I and phase II sample sizes were usually close to their expected values (Table 5).

Correlations Between Diver Counts and phase II Unit Abundance Estimates

Correlations between phase I single diver counts and phase II unit abundance estimates generally exceeded 0.80 for 1+ trout and 0.90 for 0+ coho salmon. The notable exception was runs in the 1996 East Fork of Mill Creek Survey, where a single unit affected the correlations (Table 6). Phase II sample sizes were sometimes small, $n_2 \leq 3$, however, thus complicating interpretation of estimated correlations.

Electrofishing Capture Probabilities

Estimated mean electrofishing capture probabilities ranged from 0.1476 to 0.6141 for 0+ coho salmon and 0.2515 to 0.8914 1+ trout. For 0+ coho salmon, average electrofishing capture probabilities exceeded 0.6 only for shallow pools and runs in Prairie Crk, where densities of 0+ coho salmon were usually high (Table 7). For 1+ trout, half of estimated mean electrofishing capture probabilities exceeded 0.6 (Table 8).

Table 5. Summary information for all surveys (except West Branch Mill Crk 1996, see Table 4) conducted using the modified Hankin and Reeves survey protocol. N, n₁, n₂ represent the stratum size, and the realized phase I and phase II sample sizes, respectively. With the exception of Prairie Crk, ASIS unit selection probabilities were 1/3 and 1/4 at the first and second phases. Thus expected first and second phase sample sizes are 1/3N and 1/12N, respectively.

Stream	Year	Shallow Pools			Riffles			Runs			Deep Pools			Other	
		N	n ₁	n ₂	N	n ₂	N	n ₁	n ₂	N	n ₁	n ₂	N	n ₁	n ₂
Canyon Crk	1995	77	25	6	113	14	91	29	7	70	21	0	33		
Bummer Lake Crk	1995	22	9	2	26	0	17	7	2	1	1	0	0		
	1996	12	4	1	21	2	18	5	0	4	3	0	0		
East Fork of Mill Crk	1995	67	22	3	98	5	51	22	7	38	12	0	4		
	1996	61	22	5	87	6	45	16	3	26	6	0	6		
West Branch of Mill Crk	1995	168	57	12	160	0	76	25	6	62	21	0	18		
Prairie Crk	1996	137	23	11	167	28	72	12	6	NA	NA	NA	0		
South Fork of Schooner Crk	1995	87	24	7	119	7	80	23	5	18	5	0	21		
	1996	70	26	6	117	8	60	21	6	4	0	0	13		
North Fork of Schooner Crk	1996	29	5	3	35	5	27	10	4	0	NA	NA	1		
S Fork of the Winchuck R.	1995	73	25	9	151	8	68	26	9	83	24	0	21		
Wilson Crk	1995	48	12	3	1330	9	111	43	12	52	18	0	8		

Table 6. Correlation coefficients (r_{xy}) for all surveys (except Bummer Lake Crk, 1995 and 1996 and West Branch Mill Crk 1996, see Table 4) conducted using the modified Hankin and Reeves survey protocol.

Stream	Year	n_2	Shallow Pools		Runs	
			r_{xy}		r_{xy}	
			0+ coho salmon	1+ trout	0+ coho salmon	1+ trout
Canyon Crk	1995	6	0.8746	0.9798	0.9335	0.9753
Bummer Lake Crk	1995	2	no fish obs ^a	1.0000	no fish obs ^a	1.0000
East Fork of Mill Crk	1995	3	0.9988	0.9843	0.9880	0.7140
	1996	5	0.9047	0.9420	0.9998	0.2774
West Branch of Mill Crk	1995	12	0.9415	0.9072	0.9706	0.9337
Prairie Crk	1996	11	0.9122	NA ^b	0.9787	NA ^b
South Fork of Schooner Crk	1995	7	NA ^c	0.8172	NA ^c	0.9678
	1996	6	NA ^c	0.9024	NA ^c	0.8293
North Fork of Schooner Crk	1996	3	no fish obs ^a	1.0000	no fish obs ^a	0.9919
S Fork of the Winchuck R.	1995	9	no fish obs ^a	0.9718	no fish obs ^a	0.9917
Wilson Crk	1995	3	0.9516	0.9996	0.9857	0.8268

^a No fish were observed during the first phase dive count and during the second phase calibration (electrofishing and/or MBC).

^b 1+ Trout were not counted during this survey.

^c No 0+ coho salmon were present at the time of the summer survey because the prior fall adult escapement was zero due to low water at the fish ladder. As a result, no adult coho salmon were captured in the adult trap.

Table 7. Mean estimated electrofishing capture probabilities for 0+ coho salmon. Sample sizes for means are equal to the differences between the total numbers of units electrofished in individual creeks (Total Units) and the sum of (a) the number of units in which no fish were captured (Units with Catch = 0) and (b) the number of units in which fish were captured but the MLE for abundance failed (Units with MLE Failure). Habitat Types for which Total Units = 0 are not reported.

Stream	Year	Habitat Type	Total Units	Units with $\sum Z_i = 0$	Units with MLE failure	Mean Estimated Capture Probability
Canyon Crk	1995	Riffle	14	14	0	
East Fork of Mill Crk	1995	Riffle	5	5	0	
	1996	Pool	2	0	0	0.4360
		Riffle	6	4	2	
Prairie Crk	1996	Pool	9	0	0	0.6141
		Riffle	28	22	1	0.1476
		Run	1	0	0	0.6234
West Branch of Mill Crk	1996	Pool	4	0	0	0.4052
		Riffle	17	9	3	0.2426
		Run	2	0	1	0.3320
Wilson Crk	1995	Riffle	9	9	0	
		Run	1	0	0	0.5657
S Fork of the Winchuck R.	1995	Pool	1	1	0	
		Riffle	8	8	0	

Table 8. Mean estimated electrofishing capture probabilities for 1+ trout. Sample sizes for means are equal to the differences between the total numbers of units electrofished in individual creeks (Total Units) and the sum of (a) the number of units in which no fish were captured (Units with Catch = 0) and (b) the number of units in which fish were captured but the MLE for abundance failed (Units with MLE Failure). Habitat Types for which Total Units = 0 are not reported.

Creek	Year	Habitat Type	Total Units	Units with $\sum Z_i = 0$	Units with failure	Mean Estimated Capture Probability
Canyon Crk	1995	Riffle	14	5	2	0.8471
East Fork of Mill Crk	1995	Riffle	5	1	2	0.6060
	1996	Pool	2	0	0	0.3515
		Riffle	6	1	0	0.5948
South Fork of Schooner Crk	1995	Riffle	7	1	1	0.5908
	1996	Riffle	8	0	2	0.8846
West Mill	1996	Pool	4	0	1	0.5363
		Riffle	17	9	2	0.7432
		Run	2	0	0	0.3725
Wilson	1995	Riffle	9	6	0	0.8552
		Run	1	0	0	
S Fork of the Winchuck R.	1995	Pool	1	0	0	0.2515
		Riffle	8	2	2	0.8914

Time Trials

Means and Variances by Time Interval and Species

Visual comparisons of mean counts for 0+ coho salmon and 1+ trout suggest that second and third pass means were greater than or equal to the first pass means at each time interval (Table 9; see also Appendix A, Table 17). For 0+ coho salmon, the differences between the means of the first dive pass and the means of either the second or third dive passes, depending on which was greater, were 5.5 percent, 3.4 percent, and 2.6 percent for zero, five, and 15 minutes respectively. These differences were 11.1 percent, 6.6 percent, and 2.6 percent for zero, five, and 15 minutes respectively for 1+ trout. Both sets of comparisons indicate that longer time intervals produce smaller differences in means between dive passes.

For 0+ coho salmon at all time intervals, the means of the second and third dive counts were not significantly different from one another, based on paired t-tests ($t = 0.624$, $P = 0.537$; $t = -0.302$, $P = 0.765$; and $t = -0.089$, $P = 0.930$ for zero, five, and fifteen minute intervals, respectively). Results for 1+ trout were similar at all time intervals, ($t = 0.382$, $P = 0.704$; $t = -1.013$, $P = 0.316$; and $t = -0.853$, $P = 0.398$ for zero, five, and fifteen minutes, respectively). Because mean dive counts for passes two and three were not significantly different, data were pooled and similar comparisons were made between the pooled second and third mean dive counts and the mean of the first dive count. For 1+ trout, the mean dive count for pass one was significantly different than the pooled mean dive count for passes two and three at the zero time interval ($t = -$

Table 9. Means and variances for each interval/species combination as calculated from the Time Trial data. Time Intervals are given in minutes. Tabulated values are based on diver counts made in 53 pool units counted in three Northern California creeks during 1995 and 1996 (see Table 1).

Time Interval	Pass Number	<u>0+ coho salmon</u>		<u>1+ trout</u>	
		Mean	Variance	Mean	Variance
0	1	49.13	1627.02	10.55	97.61
	2	51.87	1751.15	11.73	124.76
	3	50.97	1833.76	11.55	120.97
5	1	49.37	1598.10	10.15	100.84
	2	50.67	1855.89	10.40	94.21
	3	51.07	1914.55	10.83	106.38
15	1	48.00	1904.33	10.31	100.22
	2	49.10	1917.29	10.31	95.08
	3	49.26	1856.47	10.58	102.99

2.893, $P = 0.006$) and for 0+ coho salmon, the mean dive count for pass one was almost statistically significantly different than the pooled mean dive count for passes two and three at the zero time interval ($t = -2.019$, $P = 0.052$). Means of the first dive pass and means of the pooled passes two and three were not significantly different for either five minute or 15 minute time intervals for 0+ coho salmon ($t = -0.895$, $P = 0.378$; $t = -0.943$, $P = 0.353$) or 1+ trout ($t = -0.869$, $P = 0.389$; and $t = -0.386$, $P = 0.700$) at five minutes or 15 minutes.

Over all three creeks, however, the MBC estimates of abundance did not change appreciably across the time intervals (Table 10). Mean MBC estimates of 0+ coho salmon varied by no more than 2.8 percent among the three intervals, whereas mean MBC estimates for 1+ trout varied by no more than 12.4 percent. Pair-wise t-tests for the three combinations of time intervals indicated no significant difference in the average MBC estimates for either species ($P > 0.10$ for all comparisons).

Table 10. Means and variances of Method of Bounded Counts estimates of abundance for each interval/species combination from the Time Trial data. Time Intervals are given in minutes. Tabulated values are based on diver counts made in 53 pool units counted in three Northern California creeks during 1995 and 1996 (see Table 1).

Time Interval	<u>0+ coho salmon</u>		<u>1+ trout</u>	
	Mean	Variance	Mean	Variance
0	59.60	2397.83	14.33	167.11
5	60.00	2545.24	13.75	161.21
15	58.36	2407.10	12.75	138.99

Analysis of Deviance

Two methods were used to calculate the response variables for both species. First, observation probabilities were calculated as the ratio of the individual dive counts to the unit MBC estimate for the day. This allowed the unit population estimate to fluctuate daily. Second, a ratio of the individual dive counts to a "pooled" unit estimate of abundance (based on the nine dive counts; three counts per day over three days). This estimate of abundance was consistent with the assumption that the unit population size does not change over the three days of the dive experiment.

The GLM analysis of deviance for 0+ coho salmon showed that the Creek variable produced a statistically significant reduction in deviance for both response variables (Tables 11 - 14; see Appendix A for the data). The GLM analysis of deviance for 1+ trout with the response variable calculated with the pooled MBC estimate also showed a significant reduction in model deviance due to the Creek variable (Table 14). However, the GLM model for 1+ trout with the response variable calculated using daily MBC estimates of abundance had no variables that accounted for a significant reduction in model deviance (Table 13). Thus, the Creek factor accounted for a significant reduction in deviance for three out of four models.

Table 11 Analysis of Deviance table for the Generalized Linear Model for 0+ coho salmon with the response variable calculated as the ratio of individual dive counts to the daily MBC estimate of abundance. The NULL Residual deviance measures total variation in estimated observation probabilities. The change in deviance measures reduction in deviance attributable to a given term after previous terms have been included in the model. Residual deviance indicates the total model variation after the Deviance for each term is removed. The Chi-square probability indicates the significance of the change in the Residual Deviance.

TERM	df	Change in Deviance	Residual df	Residual Deviance	P(χ^2)
NULL			272	86.04	
I(0^first) ^a	1	0.12	271	85.92	0.731
factor(CREEK)	2	9.94	269	75.98	0.007
factor(INTORDER)	2	4.95	267	71.03	0.084
factor(first):pdi	2	1.65	265	69.38	0.438
factor(first):nDIVE	1	0.11	264	69.26	0.736
factor(first):pdi:nDIVE	2	1.00	262	68.27	0.607

^a First Dive Pass term as treated in the GLM model.

Table 12 Analysis of Deviance table for the Generalized Linear Model for 0+ coho salmon with the response variable calculated as the ratio of individual dive counts to the pooled MBC estimate of abundance. The NULL Residual deviance measures total variation in estimated observation probabilities. The change in deviance measures reduction in deviance attributable to a given term after previous terms have been included in the model. Residual deviance indicates the total model variation after the Deviance for each term is removed. The Chi-square probability indicates the significance of the change in the Residual Deviance.

TERM	df	Change in Deviance	Residual df	Residual Deviance	P(χ^2)
NULL			272	77.10	
I(0^first) ^a	1	0.12	271	76.98	0.726
factor(CREEK)	2	16.11	269	60.87	0.000
factor(INTORDER)	2	1.42	267	59.44	0.490
factor(first):pdi	2	0.14	265	59.30	0.931
factor(first):nDIVE	1	0.09	264	59.22	0.769
factor(first):pdi:nDIVE	2	0.58	262	58.64	0.749

^a First Dive Pass term as treated in the GLM model.

Table 13 Analysis of Deviance table for the Generalized Linear Model for 1+ trout with the response variable as the ratio of individual dive counts to the daily MBC estimate of abundance. The NULL Residual deviance measures total variation in estimated observation probabilities. The change in deviance measures reduction in deviance attributable to a given term after previous terms have been included in the model. Residual deviance indicates the total model variation after the Deviance for each term is removed. The Chi-square probability indicates the significance of the change in the Residual Deviance.

TERM	df	Change in Deviance	Residual df	Residual Deviance	P(χ^2)
NULL			464	169.76	
I(0^first) ^a	1	3.41	463	166.35	0.065
factor(CREEK)	2	0.63	461	165.72	0.729
factor(INTORDER)	2	4.66	459	161.06	0.097
factor(first):pdi	2	1.95	457	159.11	0.377
factor(first):nDIVE	1	0.00	456	159.11	0.992
factor(first):pdi:nDIVE	2	0.16	454	158.94	0.922

^a First Dive Pass term as treated in the GLM model.

Table 14 Analysis of Deviance table for the Generalized Linear Model for 1+ trout with the response variable calculated as the ratio of individual dive counts to the pooled MBC estimate of abundance. The NULL Residual deviance measures total variation in estimated observation probabilities. The change in deviance measures reduction in deviance attributable to a given term after previous terms have been included in the model. Residual deviance indicates the total model variation after the Deviance for each term is removed. The Chi-square probability indicates the significance of the change in the Residual Deviance.

TERM	df	Change in Deviance	Residual df	Residual Deviance	P(χ^2)
NULL			464	163.65	
I(0^first) ^a	1	1.80	463	161.84	0.179
factor(CREEK)	2	8.67	461	153.17	0.013
factor(INTORDER)	2	0.27	459	152.91	0.876
factor(first):pdi	2	0.08	457	152.82	0.959
factor(first):nDIVE	1	0.02	456	152.81	0.897
factor(first):pdi:nDIVE	2	0.01	454	152.79	0.993

^a First Dive Pass term as treated in the GLM model.

Observation Probabilities

For all three creeks in which the time trials were conducted, mean estimated observation probabilities for 0+ coho salmon ranged from 0.524 and 0.863 (Table 15). Observation probabilities were generally less on the first day than on the second or third days, but, these differences were not significant ($P > 0.05$). For 1+ trout, mean observation probabilities ranged from 0.674 to 0.878 (Table 16). In Ah-Pah and Clark's Creeks, observation probabilities again tended to be lower on the first day. In Ah-Pah Creek, the mean observation probabilities on days one and two were significantly different (Tukey-Kramer MCP; $P < 0.05$), but, there were no significant differences between days one and three or days two and three (Table 15). There were no significant differences in mean observation probabilities across days in West Branch Mill creek or Clark's Creek.

Survey Execution Costs and Results

Execution of the modified Hankin and Reeves survey design was substantially faster and more efficient than the original Hankin and Reeves (1988) survey design. From 1992 through 1994, the original Hankin and Reeves survey design was used was used at the South Fork of Schooner Creek, Oregon. During 1995 and 1996, the modified design was applied to the same reach of stream. The total number of units surveyed was approximately the same in all years (303 – 357), except for 1996 when only 264 habitat units were surveyed (Table 17). The number of days to complete both the habitat survey

Table 15. Mean estimated observation probabilities of 0+ coho salmon in different creeks for time trial data. The n column represents the total number of units in which time trials were conducted in each creek. Mean estimated observation probabilities were calculated for (a) all units, (b) units in which the number of fish was ≤ 20 , and (c) units in which the number of fish was > 20 , excluding any units in which all three counts were zero. Numbers in parentheses give the number of habitat units for calculation of means.

Stream	Date	# of Divers	N	Mean MBC Estimate of Abundance	Mean Estimated Observation Probability		
					All units with fish present	Units w/ ≤ 20 fish present	Units w/ > 20 fish present
Ah-Pah Crk	10/24/95	3	21	10.0 (4)	0.524 (4)	0.524 (4)	NA
	10/25/95	3	21	8.0 (4)	0.850 (4)	0.850 (4)	NA
	10/26/95	3	21	7.0 (4)	0.849 (4)	0.849 (4)	NA
Clark's Crk	6/5/96	2	12	3.3 (8)	0.538 (8)	0.538 (8)	NA
	6/6/96	2	12	3.0 (5)	0.750 (5)	0.750 (5)	NA
	6/7/96	2	12	2.3 (6)	0.732 (6)	0.732 (6)	NA
West Branch of Mill Crk	6/11/96	3	20	85.0 (20)	0.820 (20)	NA	0.820 (20)
	6/12/96	3	20	90.3 (20)	0.861 (20)	NA	0.861 (20)
	6/13/96	3	20	86.8 (20)	0.863 (20)	NA	0.863 (20)

Table 16. Mean estimated observation probabilities of 1+ trout in different creeks for time trial data. The n column represents the total number of units in which time trials were conducted in each creek. Mean estimated observation probabilities were calculated for (a) all units, (b) units in which the number of fish was ≤ 20 , and (c) units in which the number of fish was > 20 , excluding any units in which all three counts were zero. Numbers in parentheses give the number of habitat units for calculation of means.

Stream	Date	# of Divers	N	Mean MBC Estimate of Abundance	Mean Estimated Observation Probability		
					All units with fish present	Units w/ ≤ 20 fish present	Units w/ > 20 fish present
Ah-Pah Crk	10/24/95	3	21	8.0 (20)	0.674 (20)	0.661 (19)	0.928 (1)
	10/25/95	3	21	8.5 (20)	0.878 (20)	0.877 (19)	0.917 (1)
	10/26/95	3	21	9.6 (21)	0.781 (21)	0.784 (19)	0.744 (1)
Clark's Crk	6/5/96	2	12	2.9 (11)	0.740 (11)	0.740 (11)	NA
	6/6/96	2	12	2.2 (12)	0.831 (12)	0.831 (12)	NA
	6/7/96	2	12	2.6 (11)	0.757 (11)	0.757 (11)	NA
West Branch of Mill Crk	6/11/96	3	20	28.4 (20)	0.808 (20)	0.817 (10)	0.798 (10)
	6/12/96	3	20	24.0 (20)	0.806 (20)	0.725 (10)	0.887 (10)
	6/13/96	3	20	22.3 (20)	0.812 (20)	0.744 (10)	0.879 (10)

Table 17. Crew productivity for the three tasks (habitat-typing, phase I diving, and phase II calibration) used to complete surveys at South Schooner Creek from 1992 through 1996. Second phase electrofishing efforts are high for 1992 - 1994 due to an attempt to electrofish eight to ten units of each habitat type.

Year	Total Habitat	Numbers of Habitat Units by Task			Days to Complete each Task		
		phase I Dive	phase II MBC	phase II EFISH	Habitat-Typing	phase I Dive	phase II MBC phase II EFISH
1992	344	55	NA	27 ^a	3	4	NA 6
1993	303	57	NA	33 ^b	3	2	NA 5
1994	357	74	NA	34	3	2	NA 5
1995	324	52	12	7	2	2	1 2
1996	264	47	12	8	2	2	1 2

^a Includes three Side Channel units that were also electrofished.

^b Includes five Side Channel units that were also electrofished.

and the dive survey were slightly reduced from the original design. Reduction in total person-days—for the complete surveys—was due to reduced electrofishing effort (Table 18). Estimated survey costs were approximately \$6,047 in 1994 (original Hankin and Reeves design) as compared to approximately \$3,785 in 1997 (modified survey design).

In 1996, during the south Fork of Schooner Crk survey, a sample was drawn for use in comparison of the two survey methodologies (Table 19). (This sample was different than the sample used for generating the abundance estimates for 1996.) The habitat map generated during the regular survey was used for the comparison surveys, as were the dive counts. The same abundance estimate and sampling variance was used for the riffle stratum because only one dive unit was not calibrated; therefore, no variance could be calculated. For the units selected for phase II sampling, both methods were conducted (MBC and electrofishing) which allowed for calculation of the population estimate using both the original Hankin and Reeves (1988) methodology and the modified methodology. Using the 1996 projected survey costs the NRE value was 2.0.

The modified Hankin and Reeves survey design has a higher productivity rate (i.e., efficiency of execution), and therefore a lower cost. In 1994, approximately \$6047.00 was spent to conduct the South Schooner Creek survey. In contrast, during 1997, approximately \$3785.00 was spent. This large difference was attributed primarily to the reduction in person-days required to conduct the modified survey (Table 18).

Table 18. Approximate man-days spent conducting the original (1994) and modified (1997) surveys for South Schooner Creek for 1994 and 1997.

Year	Task	Number of People	Number of Days	Total person-days to complete the task
1994	Habitat Classification	2	3	6
	Dive Counts (phase I only)	2	2	4
	Electrofishing	7	5	35
	TOTAL			45
1997	Habitat Classification	3	2	6
	Dive Counts (phase I & II)	2	2	4
	Electrofishing	6.7 ^a	3	20
	TOTAL			

^a Over the three days, there were five, seven, and eight people, respectively, on the electrofishing crew.

Table 19. Summary information for comparison of the two survey designs based on a single sample drawn from the 1996 South Fork of Schooner Crk survey. The left side of the table lists the tasks, estimated hours to complete each, and the cost associated with completion of each survey task. (The Cost figures are based strictly on the cost of conducting the work, i.e., they do not include costs such as vehicles, lodging, etc.) The right side of the table shows the estimates, sampling variance, and sample sizes for each habitat stratum.

Survey Design	Task	Person Hours	Total Cost	Habitat Type	$\hat{Y}$	$\hat{V}(\hat{Y})$	N	n1	n2
Original H&R									
	Habitat Type	44	\$401.50	Pool	829.8	27,977.0	70	26	7
	Snorkeling	32	\$288.00	Run	519.6	23,262.1	60	22	10
	Electrofishing	197	\$1,904.75	Riffle	1,828.4	473,400.4	117	8	NA
	TOTAL	273	\$2,594.25		3,177.7	524,639.5			
Modified H&R									
		44	\$401.50	Pool	451.7	2,601.7	70	26	7
		32	\$288.00	Run	306.0	1,421.0	60	22	10
		70	\$732.50	Riffle	1,828.4	473,400.4	117	8	NA
	TOTAL	146	\$1,422.00		2,586.1	477,423.1			

DISCUSSION

Although preliminary applications of the modified Hankin and Reeves survey design appeared promising, several additional changes seem needed. First, high numbers of juvenile salmonids found in the deep pools suggests a need for further stratification of deep pools on the basis of complexity. Second, implementation of the Method of Bounded Counts had several issues that became apparent during field execution. Finally, several other topics, including development of the upstream and downstream limits of application for these surveys, and determination of optimum crew configuration require further study.

Stratification of Habitat Units

The modified Hankin and Reeves design proposed stratification of units into shallow pools, runs, riffles, deep pools, and "Other". Deep pools (>1.1 m maximum depth) were defined as (a) pool habitat that was too deep for electrofishing (see Kramer 1993, Heggenes et al. 1990, Griffith 1981, and Shepard 1983), and/or (b) too complex for valid use of MBC. Data collected in West Branch of Mill Creek in 1995 suggested that the Deep Pool stratum was of substantial importance to 0+ coho salmon (Table 4?). The Deep Pool estimate of abundance for 0+ coho salmon represented 29% of the sum of estimates across all habitat strata. However, deep pools represented only 16% of total primary channel surface area and estimates of fish abundance in deep pools probably have substantial negative bias due to the use of MBC at high fish abundance. For 1+ trout, estimated abundance was 21% of total estimated abundance.

Field experience suggested that deep pools fit into one of two general categories:

Deep pools lacking in complexity (relatively small amounts of large wood, boulders, etc.) and deep pools with substantial complexity (log-jams, boulder cover, etc.). In the later type of Deep Pool, it would not be valid to assume that divers would not double count fish, whereas in the former type this assumption might be reasonable (see below).

Based on fieldwork conducted during 1995 and 1996, I therefore recommend the following subcategories of pool habitat:

1. Shallow pools, as defined in the Materials and Methods section;
2. Deep pools, defined as pool habitat that is too deep to electrofish (maximum depth >1.1 m) but not too deep or too complex to rule out application of MBC;
3. Complex Pools, defined as pool habitat that prevents effective calibration by MBC or electrofishing due to complexity.

Thus, shallow pools would be calibrated either by MBC or electrofishing (depending on first phase dive counts); MBC would be used in deep pools; and no sampling would take place in Complex Pools. If deep pools and Complex Pools could be objectively classified, then the proportion of the total stream length accounted for by Complex Pools could be calculated from a complete habitat map and these units could be included in the "other" stratum.

Several measures of habitat complexity were considered while developing the survey protocol. In general, any measure of habitat complexity had to meet at least the following two criteria: First, any metric needed to be repeatable among survey crews (i.e., a small degree of subjectivity). Second, any techniques used needed to be quick

(i.e., not take much time at each habitat unit). Consideration was given to various schemes that were based on ranking habitat complexity (see below), however, these were often subjective and lacked rigid repeatability. Techniques such as substrate rugosity (the relationship between the surface distance across the complexity in question and a straight line distance; see for example, Luckhurst and Luckhurst 1978) were judged too labor intensive to be conducted at each pool unit.

Differentiating between deep pools and Complex Pools would, however, require development of objective methods for quantifying complexity. First, some actual measurement of environmental variables (as defined by the study or survey) considered to provide complexity. For example, Binns and Eiserman (1979) defined a list of environmental variables they felt provided "areas...where a trout can rest and hide..." and calculated a percentage of cover based on measured area of those variables. Alternatively, a rating system may be used to classify complexity. For example, Flossi and Reynolds (1994) proposed a rating scale of 0.0 to 3.0, with 0.0 having no shelter and 3.0 having some combination of a list of complexity variables. For the proposed modified survey design, the former method would be too time consuming, whereas the later method may be too subjective.

Using ASIS in the Field

Although ASIS maintains random unit selection and prevents prior knowledge of the units to be sampled, it was initially difficult to implement this selection method in the field. Among other things, the APSIS strips can recede into the canister, thus causing the

user to loose track of position in the sequence. A single position could possibly be used several times if this happened repeatedly.

Crossing off each ASIS entry and writing the habitat unit number on the strip next to the appropriately used position eliminated these problems. A Quality Control (QC) sheet was also developed to check for proper unit selection (see Appendix C for an example). At the end of the day, the user listed out each habitat type (pool, riffle, etc.) and marked the units actually selected in the field. This list was then compared with a list of units that ought to have been selected by the ASIS algorithm. This allowed the user to correctly identify the sample drawn, and make any necessary appropriate field adjustments the following day, such as adjusting flags or diving the correct unit. With these simple techniques, almost no errors were made using ASIS in the field.

Method of Bounded Counts

Field application of the modified protocol revealed several important concerns regarding the use of visual observations. These concerns are of special significance for the legitimate implementation of MBC. These include (a) violation of the assumptions of MBC due to fish behavior, and (b) the distinction of age classes for trout.

In South Fork Schooner Creek, divers consistently had problems in visual differentiation of cutthroat trout and steelhead. These two species were therefore combined into a single "1+ and older trout" category. Although larger, distinctly identifiable cutthroat trout were not treated separately from 1+ trout, they could have been tallied as a separate category.

Due to the highly mobile nature of juvenile salmonids, the possibility of counting a fish twice, and therefore violating one of the assumptions of MBC, is a concern when using this technique in stream surveys. Field situations that lead to double counting include habitat units with large numbers of fish (Heggenes et al. 1990) or extreme complexity. Because MBC is recommended for use with unit population sizes ≤ 20 , the former should not be, on average, a concern. The latter, however, is much more of a concern as woody debris and other forms of cover provides fish the opportunity to appear, disappear, and reappear in the divers field of vision. Both of these conditions limit the practical field application of MBC. The modified Pool habitat classification scheme described above should result in the use of MBC in locations where it can be applied most successfully (i.e., in units with little complexity and smaller numbers of fish).

Numbers of fish present in West Branch of Mill Creek in deep pools were estimated using only the MBC, and these estimates have substantial negative bias due to application of the MBC estimator to "large" population sizes (Hankin, 1999). For the Deep Pool stratum, 14 of 15 calibrated units had single dive counts exceeding 30 0+ coho salmon. Assuming no double counting took place, the true magnitude of negative bias is unknown and depends on both observation probability and true fish numbers. For 1+ trout, only two of 15 units had single dive counts greater than or equal to 30 fish. Thus, estimated numbers of 1+ trout in deep pools should have much smaller negative bias than corresponding estimates of 0+ coho salmon.

The use of MBC in deep pools is generally subject to both of the criteria that could contribute to violation of the double counting assumption of the estimator (see above). With a large unit population size (say >50 ; particularly in deep pools), divers could double count fish when (a) a locally "patchy" fish distribution was associated with woody cover, or (b) fish numbers were too large to allow reliable counting (Heggenes et al. 1990). If the fish distribution is uniform over the length of the habitat unit, then the diver would be less like to double count fish, whereas any sort of clumped distribution would have an impact on the dive count. Further, Hillman et al. (1992) found that divers undercounted juvenile salmonids by 50% or more if they were in schools of 40 or more fish indicating the difficulty associated with counting large schools of fish. While the use of MBC in deep pools tends to violate the assumptions of the estimator more, it is still the only technique available for calibration of these units.

Species-specific behaviors may also influence the performance of MBC. Juvenile coho salmon often appear "curious" and will school in front of the diver. If these schools are large enough, however, double counting of individual coho salmon may take place. Because of the pelagic nature of juvenile chinook salmon, they are also easily counted in small- to medium- sized habitat units provided that schools are small. Steelhead tend to be wary, but a skilled diver approaching them cautiously will usually be successful in not disturbing the fish. If a diver rushes or is clumsy, however, then steelhead tend to move into cover and hide. Cutthroat tend toward a fright response and can rapidly swim up and down a unit when they encounter a diver, thus leading to double counting of individuals.

In this study, a fixed 85 mm fork length was used to separate 0+ trout from 1+ and older trout in all applications of the modified survey design. Such a fixed cutoff value does not account for growth of 0+ and 1+ trout over the summer field season. In some streams, some 0+ trout may exceed 85 mm fork length by mid-summer, whereas 1+ trout are nearly all larger than 85 mm at the same time of the summer. Thus, it may make more sense for the cutoff length to be increased as the summer field season progresses.

Time Interval Recommendations

Due to the complex nature of the Time Trials experiment several analysis approaches were used; each analysis procedure produced distinct results. First, the substantial reduction in model deviance due to the Creek variable in the GLM analysis suggested that Creek had the greatest impact on observation probabilities. Second, differences in mean dive counts between passes at the different time intervals suggest that some elapsed period of time between dive passes is warranted. Finally, observation probabilities appear to vary with day and across creeks.

Based on the results presented in this thesis, the duration of time between dive passes appears to have no influence on observation probabilities as modeled with the GLM (Tables 11-14). GLM analyses showed that time interval length made non-significant contribution to reduction in deviance for both species regardless of the formation of the response variable. The variable Creek made much larger and significant reductions in model deviance for both species when the observation probability was calculated using the pooled MBC estimate. This variable is confounded with date, however, because time trials were not conducted on all creeks on the same dates (Table

2). Further, with the exception of one diver, there were different divers present at each creek.

Residual deviance remaining after the GLM fit to the full models was still very large for both species regardless of the model used. The total reduction in deviance for 0+ coho salmon was 20.7 and 23.9 percent for the daily MBC estimates and the pooled MBC estimates models, respectively. For 1+ trout, the total reduction in deviance was only, 6.4 and 7.1 percent for the daily MBC estimates and the pooled MBC estimates models, respectively. The small reduction in deviance for all four models indicates that the constructed GLM models did not fit the data well (McCullagh and Nelder 1989).

Mean dive counts for the first dive pass for both species were slightly lower than the mean dive counts for the second or third dive pass (Table 9). For the zero time interval, the mean dive count for the first dive pass and the pooled mean dive count for passes two and three was significantly different. It therefore seems reasonable to recommend a time interval of no less than five minutes between successive counts. Further, this interval should be extended if a diver has a reason (e.g., turbidity caused by disturbance).

Although estimated observation probabilities are positively biased, it is evident that these probabilities change between days (Tables 15,16). Much of the realized change in observation probabilities between day one and days two and three (that which is not due to the biases of the statistic) probably arise from "diver learning". By the end of the first day, the diver has conducted three dive passes in each unit, leading to familiarity with the individual habitat units. In general, the decline in observation

probability between day two and day three might be related to repeated disturbance of the fish over the previous two days, thereby possibly confounding interpretation of the results. The design of the Time Trial experiment produced repeated disturbance of the same habitat unit. Such repeated disturbance does not occur during application of MBC in a regular survey. These statistical results suggest that the location and individual diver are having a greater impact on observation probability than duration between dives, but interpretation of these results is complicated by the bias associated with calculating estimated observation probabilities.

Crew Configuration and Direction of Travel

The direction that the sampling crew travels affects several aspects of survey execution such as unit classification, pre-dive disturbance of fish, travel times, data handling (after the survey), etc. Stream surveys are usually carried out in an upstream direction. Crews begin at a downstream point and travel upstream to a finish point. If the only feasible access point to a reach is at the middle or upstream end of the reach, then a crew is presented with two options. They may travel downstream and start working upstream, or they may travel upstream and start working downstream.

Habitat-typing in an upstream direction is the most logical approach and the modified Hankin and Reeves protocol is best suited to being carried out in an upstream direction. Habitat units are numbered in an ascending sequential order. If habitat typing is instead carried out downstream, then units have to be numbered in a descending sequential order (see Materials and Methods). This can lead to data transcription errors

in the data set. Split flows, in particular, become very difficult to transcribe because of unit ordering and Channel Code numbering.

Diving of individual units must take place in an upstream direction. If a dive crew works downstream, then the crew is always upstream proceeding downstream to the next dive unit. While traveling, divers can dislodge sediment or disturb fish as they walk to the downstream end of the next dive unit. Further, the caution that divers would have to employ while traveling downstream would increase the likelihood of walking past a unit boundary flag. Traveling upstream eliminates all of these issues, and divers are not forced to walk the length of each unit before beginning their dive.

In this study, electrofishing crews had from three to eight members as dictated by stream size. Field crews of two persons each were typically used for habitat-typing and diving. No individual was alone on the stream, although the two divers "leap-frogging" positions were frequently separated from one another. Informal experiments were conducted with other crew configurations, and while no measurements of task performance were made, interviews conducted with field personnel suggested that crews of two people each were most efficient. For example, a crew of one habitat-typer and one diver was used for a single day. This configuration made it impossible to take habitat measurements before the dive counts could be made. Habitat units were first classified, fish were counted (if selected for snorkel counts), and units were measured. Depth measurements should have been taken before unit classification with diving afterwards so as to minimize unit classification errors. Because the diver on the crew had to spend the entire day in a wetsuit taking measurements, field personnel indicated a greater amount of

fatigue both at the end of the day and at the end of the week. This led to an overall decrease in productivity for the day and the week.

Another experimental configuration tested relied on use of four divers to conduct the dive survey on the East Fork of Mill Creek for both 1995 and 1996. The majority of the units selected for phase I sampling required only one diver. When a unit was selected that required two divers, the other two divers were free to proceed upstream to the next available dive units. However, coordination of the ASIS canister required extra efforts with this configuration. It became imperative that each individual cross out the ASIS position used for each unit (see previous discussion). There were no other problems with using four divers to conduct the survey.

A crew size of two people allows for habitat classification and diving to occur in an intuitive manner. Divers can leap-frog dive units and thus have a rest period between dives. A two person habitat crew can handle measurements and flagging efficiently. With separate crews performing different tasks, each crew can work on a different segment of stream simultaneously without interfering with the other crew. Finally, these crews can also be combined for any required electrofishing.

Downstream and Upstream Limits of Effective Application

The original Hankin and Reeves (1988) survey design has been applied to streams with a wide range of sizes and flow characteristics throughout the Pacific Northwest and Southeastern United States. In some instances, this survey design has probably been applied in contexts where it has not been appropriate, either because a stream has been too large (i.e., too deep or wide) to allow valid calibration or because a stream has been

too small for efficient sampling at a habitat unit level. Based on field tests of the modified survey design, the following criteria are recommend for upstream (too small) and downstream (too large) limits of application:

1. Upstream limit - When individual slow water units become too shallow for successful dive counts (<0.4 m) second order stream (0 and 1st order streams) then fixed length segments of stream should be randomly selected for removal method estimation as described in Hankin (1984). These streams are small and, as such, are comprised mostly of riffle habitat.
2. Downstream limit - When Shallow Pool units require more than two divers (due to stream width and/or visibility) to effectively count fish, then the survey is not effective, and should not be used.

Application of these criteria should eliminate application of phase II sampling methods in situation where they both will function poorly. Pools greater than 1.1 meters deep are not conducive for electrofishing, and using more than two divers allows for an unacceptable level of potential double counting of fish. The degree to which a stream will meet the criteria varies. If only one pool is not acceptable (e.g., too wide), then the survey can probably be completed with reasonable confidence, however if the majority of the pools are not acceptable, then an index of abundance, such as single dive counts, should seriously be considered.

Expenditures of Time and Effort

Comparison of two sampling designs depends primarily on (a) the fraction of units sampled (n and N), (b) the total sampling variance, and (c) the costs associated with

each design (Hankin 1984). NRE is one mechanism used to compare two sampling designs. This comparison of two surveys is only applicable when the same data (i.e., sample) is used in each sampling design. (Formally, one could, for instance, compare sampling with replacement versus sampling without replacement by using the NRE.) Otherwise, by chance (i.e., random sampling) one sampling scheme may appear to perform particularly well or particularly poorly because of the sample drawn. Therefore, in order to compare two sampling designs, the same sample should be used to generate the variance for each design. Comparison of the Hankin and Reeves and the modified Hankin and Reeves survey protocols using the NRE or another statistical test (e.g., a t-test) requires a dataset that was gathered in a like fashion for both sampling designs. However, the various differences in the protocol, for example, unit selection for the phase I and phase II units (ASIS versus systematic) do not typically allow for direct comparison of a single dataset. Therefore discussions of efficiency of one protocol over the other have to take place in a different fashion.

The sample gathered during the 1996 South Fork of Schooner Crk survey was collected with the intent of comparing the two schemes. However, the data gathered does not reflect a complete implementation of either scheme. Several pieces of the data were used for calculation of abundance estimates from both the original and modified survey protocols. For example, the habitat map, phase I dive data, and the electrofishing data for riffles were used in both sets of calculations.

There are three interesting points to note with this comparison. First, that the NRE value is 2.0, which indicates that given this sample and the estimated amount of

money spent, that the modified protocol was twice as efficient as the original protocol.

Second, 17 more units were electrofished using the original protocol, thereby increasing the total cost by \$1,172.25. (The cost of the survey only reflects actual expenditures for fieldwork and does not include other operational costs such as lodging, etc.)

Sample size, for both the phase I and phase II sampling will have a direct impact on the amount of time required to implement a survey (and, therefore money expended) and will influence the overall sampling variance (greater variation between units than within units, Hankin 1984). For a fixed N , systematic sampling will a constant sample sizes (assuming N/k is an integer), whereas ASIS may not. On average, given the field applications of ASIS and the sampling rates set, ASIS did produce reasonably consistent sample sizes (Table 5).

The tradeoff of a constant sample size (using ASIS instead of systematic sampling) is the reduction of non-sampling biases introduced through systematic sampling. Prior knowledge of unit selection for the phase II sample could have untold impacts if a diver were to "try harder" in those units. There is no formal way to measure these non-sampling biases, however, standard Sampling Theory texts caution against introducing this type of error into a survey (see, for example, Cochran 1977, and Sarndal, et al. 1992).

Second phase electrofishing efforts can range from zero (all phase I dive counts in those units selected for phase II sampling are less than 20 fish) to the expected phase II sample size under the original Hankin and Reeves survey protocol (all phase I dive counts in those units selected for phase II sampling are greater than 20 fish). This

indicates that unless the target species in a given stream is uniformly dense, which is usually not the case for most salmonid populations today (some combination of generally depressed numbers and patchy distributions over the length of a survey), some fraction of the phase II sampling will be conducted by MBC. Any use of MBC, by default, reduces the amount of electrofishing, and therefore the total financial expenditure to conduct a survey.

Sampling variance for the modified Hankin and Reeves survey protocol should be about the same as that for the original Hankin and Reeves protocol. This is driven, in part by both the observation probabilities and the electrofishing capture probabilities, which is influenced, in part, by the target species and the habitat stratum in question. It is reasonable to assume that there will be not much change of either type of probability based on the survey protocol implemented.

Therefore, the modified Hankin and Reeves survey protocol has (a) a greater speed of implementation (from the use of MBC for phase II sampling), (b) the reduce reliance on electrofishing as a calibration technique (once again, from the use of MBC for Phase II sampling), and (c) the reduction of non-sampling biases (from the use of ASIS).

Conclusion

Based on two summers of fieldwork, it is evident that observation probabilities and electrofishing capture probabilities differ substantially in the clear-water small stream systems of the Northern California and Oregon. The low conductivity of these systems appears to make electrofishing performance poor. Conversely, the low levels of suspended solids and excellent visibility of the systems creates an environment where

direct observation of fish is possible. The modified Hankin and Reeves survey design used in this study takes powerful advantage of direct observation by structuring the survey to use MBC in situations of maximum effectiveness.

Given the current and future listings of various salmonid stocks under the Endangered Species Act of 1973, electrofishing will become a less acceptable technique for capture of salmonids (see, for example, Nielsen 1998). Other methods need to be developed to replace or minimize the use of electrofishing. The modified Hankin and Reeves survey may be a large step forward in development of these new techniques. The Method of Bounded Counts is a non-invasive technique that, under ideal conditions, produces an accurate estimate of abundance in low density situations without the mortality or injury commonly associated with electrofishing.

REFERENCES CITED

- Binns, N. A. and F. M. Eiserman. 1979. Quantification of fluvial trout habitat in Wyoming. *Transactions of the American Fisheries Society* 108:215-228.
- Bisson, P. A., J. L. Nielsen, and R. A. Palmason. 1982. A system of naming habitat types in small streams, with examples of habitat utilization by salmonids during low streamflow. Pages 62-73 in N. B. Armantrout, ed. *Acquisition and utilization of aquatic habitat inventory information*. American Fisheries Society, Western Division, Bethesda, MD.
- Cleveland, W. S. 1993. *Visualizing data*. Hobart Press. Summit, New Jersey. 360 pages.
- Cochran, W. G. 1977. *Sampling Techniques*. John Wiley and Sons New York, New York. 428 pages.
- Dolloff, C. A., D. G. Hankin, and G. H. Reeves. 1993. Basinwide estimation of habitat and fish populations in streams. USFS General Technical Report SE-83.
- Everest, F. H., and D. W. Chapman. 1972. Habitat selection and spatial interaction by juvenile chinook salmon and steelhead trout in two Idaho streams. *Journal of the Fisheries Research Board of Canada* 29:91-100.
- Fausch, K. D., and R. J. White. 1981. Competition between brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) for positions in a Michigan stream. *Canadian Journal of Fisheries and Aquatic Sciences* 38:1220-1227.
- Flosi, G., and F. L. Reynolds. 1994. *California salmonid stream habitat restoration manual*. 2nd ed. Pacific Lumber Company, Scotia, California.
- Gardiner, W. R. 1984. Estimating population densities of salmonids in deep water in streams. *Journal of Fish Biology* 24:41-49.
- Gibson, R. J. 1978. The behavior of juvenile Atlantic Salmon (*Salmo salar*) and brook trout (*Salvelinus fontinalis*) with regard to temperature and to water velocity. *Transactions of the American Fisheries Society* 107:703-712.
- Goldstein, R. M. 1978. Quantitative comparison of seining and underwater observation for stream fishery surveys. *Progressive Fish-Culturist* 4:108-111.

- Griffith, J. S. 1981. Estimation of the age frequency distribution of stream-dwelling trout by underwater observation. *Progressive Fish-Culturist* 43:51-53.
- Hankin, D. G. 1999. Improved two-phase survey designs for estimation of fish abundance in small streams. Unpublished manuscript submitted to *Transactions of the American Fisheries Society*, Oct. 1997.
- Hankin, D. G. 1984. Multistage sampling designs in fisheries research: applications in small streams. *Canadian Journal of Fisheries and Aquatic Sciences* 41:1575-1591.
- Hankin, D. G., and G. H. Reeves. 1988. Estimating total fish abundance and total habitat area in small coastal streams based on visual estimation methods. *Canadian Journal of Fisheries and Aquatic Sciences* 45:834-844.
- Hawkins, C. P., J. L. Kershner, P. A. Bisson, M. D. Bryant, L. M. Decker, S. V. Gregory, D. A. McCullough, C. K. Overton, G. H. Reeves, R. J. Steedman, and M. K. Young. 1993. A hierarchical approach to classifying stream habitat features. *Fisheries* 18(6):3-12.
- Hayes, J. W., and D. B. Baird. 1994. Estimating relative abundance of juvenile brown trout in rivers by underwater census and electrofishing. *New Zealand Journal of Marine and Freshwater Research* 28:243-253.
- Heggenes, J., A. Brabrand, and S. J. Saltveit. 1990. Comparison of three methods for studies of stream habitat use by young brown trout and Atlantic salmon. *Transactions of the American Fisheries Society* 119:101-111.
- Helfman, G. S. 1983. Underwater methods. Pp. 349-370. In: Nielson, L. A. and D. L. Johnson, eds. *Fisheries Techniques*. Bethesda, MD: American Fisheries Society.
- Hillman, T.W., J. W. Mullan, and J. S. Griffith. 1992. Accuracy of underwater counts of juvenile chinook salmon, coho salmon, and steelhead. *North American Journal of Fisheries Management* 12:598-603.
- Keenleyside, M. H. A. 1962. Skin-diving observations of Atlantic Salmon and brook trout in the Miramichi River, New Brunswick. *Journal of the Fisheries Research Board of Canada* 19(4):625-633.
- Kramer, S. H. 1993. Habitat specificity of wild juvenile (1+) steelhead within South Fork Trinity River tributaries during low summer flow. MS Thesis, Humboldt State University.

- Luckhurst, B.E. and K Luckhurst. 1978. Analysis of the influence of substrate variables on coral reef fish communities. *Marine Biology* 49:317:323.
- McCain, M., D. Fuller, L. Decker, and K. Overton. 1990. USDA Forest Service, Pacific Southwest Region. Stream habitat classification and inventory procedures for northern California. R-5's Fish Habitat Relationships Technical Bulletin No.1, 15 pp.
- McCullagh, P., and J. A. Nelder. 1989. Generalized Linear Models. Chapman & Hall, London. 511 pp.
- Nielsen, J. 1998. Electrofishing California's endangered fish populations. *Fisheries* 23(12):6-12.
- Northcote, T. G., and D. W. Wilkie. 1963. Underwater census of stream fish populations. *Transactions of the American Fisheries Society* 92:146-151.
- Robson, D. S., and J. H. Whitlock. 1964. Estimation of a truncation point. *Biometrika* 51:33-39.
- Rodgers, J. D., M. F. Solazzi, S. L. Johnson, and M. A. Buckman. 1992. Comparison of three techniques to estimate juvenile coho salmon populations in small streams. *North American Journal of Fisheries Management* 12:79-86.
- Roper, B. B., and D. L. Scarnecchia. 1995. Observer variability in classifying habitat types in stream surveys. *North American Journal of Fisheries Management* 15:49-53.
- Sarndal C.E., B. Swensson, and J. Wretman. 1992. Model Assisted Survey Sampling. SpringerVelag New York, New York. 694 pages.
- Schill, D. J., and J. S. Griffith. 1984. Use of underwater observations to estimate cutthroat trout abundance in the Yellowstone River. *North American Journal of Fisheries Management* 4:479-487.
- Seber, G. A. F. 1994. Estimation of Animal Abundance. 2nd ed. John Wiley and Sons. New York, New York 632 pages.
- Shepard, B. B. 1983. Evaluation of a combined methodology for estimating fish abundance and lotic habitat in mountain streams of Idaho. MS Thesis, University of Idaho.
- Shrivell, C. S. 1994. Effect of changes in streamflow on the microhabitat use and movements of sympatric juvenile coho salmon (*Oncorhynchus kisutch*) and

chinook (*O. tshawytscha*) salmon in a natural stream. Canadian Journal of Fisheries and Aquatic Sciences 51:1644-1652.

Slaney, P. A., and A. D. Martin. 1987. Accuracy of underwater census of trout populations in a large stream in British Columbia. North American Journal of Fisheries Management 7:117-122.

Stevens, J. 1992. Applied Multivariate Statistics for the Social Sciences. 2nd ed. Lawrence Erlbaum Associates. Hillsdale, New Jersey 629 pages.

Thurrow, R. 1997. Habitat utilization and diel behavior of juvenile bull trout (*Salvelinus confluentus*) at the onset of winter. Ecology of Freshwater Fishes 6:1-7.

Thurrow, R. 1994. Underwater methods for study of salmonids in the intermountain west. USFS General Technical Report INT-307.

Thurrow, R., and D. J. Schill. 1996. Comparison of day snorkeling, night snorkeling, and electrofishing to estimate bull trout abundance and size structure in a second-order Idaho stream. North American Journal of Fisheries Management 16:314-323.

Whitworth, W. R., and R. E. Schmidt. 1980. Snorkeling as a means of evaluating fish populations in streams. New York Fish and Game Journal 27:91-94.

Zubick, R. J., and J. J. Fraley. 1988. Comparison of snorkel and mark-recapture estimates for trout populations in large streams. North American Journal of Fisheries Management 8:58-62.

APPENDICES

APPENDIX A. TIME TRIAL DATA.

Table 20. Data gathered to test the impact of different time delays on repeated dive counts. UNIT represent the sequential numbering of pool units used in each set of time trials. SPP is the species present in each habitat unit. DIVER is a six letter code for the individuals that conducted the dive counts. INT is the time interval assigned at random. LENGTH and MMAX are physical habitat measurements of channel length and measured maximum depth, respectively. MBC is the daily unit population estimate generated by the Method of Bounded Counts. COUNT is the dive count for the time interval/dive pass number/species combination. NDIVE is the dive pass number. Pdi and first are coding variables that separate the time intervals and the first dive pass from subsequent dive passes, respectively. MBC.total is the pooled MBC estimate for each pool unit. INTORDER is the the day order of the three days that dive counts were conducted at each pool. If a species unit combination is not represented, then that species was not counted in the unit.

CREEK	DATE	UNIT	SPP	DIVER	INT	LENGTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
AHPAH	10/24/1995	1	COHO	HANKBR	15	33.7	0.58	11	4	1	9	0	9	1
AHPAH	10/24/1995	1	COHO	HANKBR	15	33.7	0.58	11	5	2	0	1	9	1
AHPAH	10/24/1995	1	COHO	HANKBR	15	33.7	0.58	11	8	3	0	1	9	1
AHPAH	10/25/1995	1	COHO	HANKBR	0	33.7	0.58	10	8	1	9	0	9	2
AHPAH	10/25/1995	1	COHO	HANKBR	0	33.7	0.58	10	9	2	1	1	9	2
AHPAH	10/25/1995	1	COHO	HANKBR	0	33.7	0.58	10	7	3	1	1	9	2
AHPAH	10/26/1995	1	COHO	HANKBR	5	33.7	0.58	9	9	1	9	0	9	3
AHPAH	10/26/1995	1	COHO	HANKBR	5	33.7	0.58	9	7	2	2	1	9	3
AHPAH	10/26/1995	1	COHO	HANKBR	5	33.7	0.58	9	9	3	2	1	9	3
AHPAH	10/24/1995	1	TROUT	HANKBR	15	33.7	0.58	24	14	1	9	0	46	1
AHPAH	10/24/1995	1	TROUT	HANKBR	15	33.7	0.58	24	12	2	0	1	46	1
AHPAH	10/24/1995	1	TROUT	HANKBR	15	33.7	0.58	24	19	3	0	1	46	1
AHPAH	10/25/1995	1	TROUT	HANKBR	0	33.7	0.58	24	22	1	9	0	46	2
AHPAH	10/25/1995	1	TROUT	HANKBR	0	33.7	0.58	24	15	2	1	1	46	2
AHPAH	10/25/1995	1	TROUT	HANKBR	0	33.7	0.58	24	20	3	1	1	46	2
AHPAH	10/26/1995	1	TROUT	HANKBR	5	33.7	0.58	47	34	1	9	0	46	3
AHPAH	10/26/1995	1	TROUT	HANKBR	5	33.7	0.58	47	21	2	2	1	46	3
AHPAH	10/26/1995	1	TROUT	HANKBR	5	33.7	0.58	47	21	3	2	1	46	3
AHPAH	10/24/1995	2	COHO	HANKBR	5	19.8	0.70	10	7	1	9	0	9	1
AHPAH	10/24/1995	2	COHO	HANKBR	5	19.8	0.70	10	4	2	2	1	9	1
AHPAH	10/24/1995	2	COHO	HANKBR	5	19.8	0.70	10	0	3	2	1	9	1
AHPAH	10/25/1995	2	COHO	HANKBR	15	19.8	0.70	10	8	1	9	0	9	2
AHPAH	10/25/1995	2	COHO	HANKBR	15	19.8	0.70	10	4	2	0	1	9	2
AHPAH	10/25/1995	2	COHO	HANKBR	15	19.8	0.70	10	6	3	0	1	9	2
AHPAH	10/26/1995	2	COHO	HANKBR	0	19.8	0.70	7	6	1	9	0	9	3
AHPAH	10/26/1995	2	COHO	HANKBR	0	19.8	0.70	7	5	2	1	1	9	3
AHPAH	10/26/1995	2	COHO	HANKBR	0	19.8	0.70	7	0	3	1	1	9	3
AHPAH	10/24/1995	2	TROUT	HANKBR	5	19.8	0.70	22	17	1	9	0	25	1
AHPAH	10/24/1995	2	TROUT	HANKBR	5	19.8	0.70	22	12	2	2	1	25	1

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
AHPAH	10/24/1995	2	TROUT	HANKBR	5	19.8	0.70	22	7	3	2	1	25	1
AHPAH	10/25/1995	2	TROUT	HANKBR	15	19.8	0.70	28	21	1	9	0	25	2
AHPAH	10/25/1995	2	TROUT	HANKBR	15	19.8	0.70	28	14	2	0	1	25	2
AHPAH	10/25/1995	2	TROUT	HANKBR	15	19.8	0.70	28	12	3	0	1	25	2
AHPAH	10/26/1995	2	TROUT	HANKBR	0	19.8	0.70	16	12	1	9	0	25	3
AHPAH	10/26/1995	2	TROUT	HANKBR	0	19.8	0.70	16	14	2	1	1	25	3
AHPAH	10/26/1995	2	TROUT	HANKBR	0	19.8	0.70	16	4	3	1	1	25	3
AHPAH	10/24/1995	3	TROUT	GINOSA	15	18.8	0.94	23	21	1	9	0	33	1
AHPAH	10/24/1995	3	TROUT	GINOSA	15	18.8	0.94	23	22	2	0	1	33	1
AHPAH	10/24/1995	3	TROUT	GINOSA	15	18.8	0.94	23	21	3	0	1	33	1
AHPAH	10/25/1995	3	TROUT	GINOSA	0	18.8	0.94	29	24	1	9	0	33	2
AHPAH	10/25/1995	3	TROUT	GINOSA	0	18.8	0.94	29	29	2	1	1	33	2
AHPAH	10/25/1995	3	TROUT	GINOSA	0	18.8	0.94	29	29	3	1	1	33	2
AHPAH	10/26/1995	3	TROUT	GINOSA	5	18.8	0.94	33	31	1	9	0	33	3
AHPAH	10/26/1995	3	TROUT	GINOSA	5	18.8	0.94	33	31	2	2	1	33	3
AHPAH	10/26/1995	3	TROUT	GINOSA	5	18.8	0.94	33	32	3	2	1	33	3
AHPAH	10/24/1995	4	COHO	CHRISM	15	15.3	1.07	10	1	1	9	0	8	1
AHPAH	10/24/1995	4	COHO	CHRISM	15	15.3	1.07	10	4	2	0	1	8	1
AHPAH	10/24/1995	4	COHO	CHRISM	15	15.3	1.07	10	7	3	0	1	8	1
AHPAH	10/25/1995	4	COHO	CHRISM	0	15.3	1.07	6	6	1	9	0	8	2
AHPAH	10/25/1995	4	COHO	CHRISM	0	15.3	1.07	6	6	2	1	1	8	2
AHPAH	10/25/1995	4	COHO	CHRISM	0	15.3	1.07	6	6	3	1	1	8	2
AHPAH	10/26/1995	4	COHO	CHRISM	5	15.3	1.07	6	5	1	9	0	8	3
AHPAH	10/26/1995	4	COHO	CHRISM	5	15.3	1.07	6	6	2	2	1	8	3
AHPAH	10/26/1995	4	COHO	CHRISM	5	15.3	1.07	6	6	3	2	1	8	3
AHPAH	10/24/1995	4	TROUT	CHRISM	15	15.3	1.07	9	3	1	9	0	14	1
AHPAH	10/24/1995	4	TROUT	CHRISM	15	15.3	1.07	9	7	2	0	1	14	1
AHPAH	10/24/1995	4	TROUT	CHRISM	15	15.3	1.07	9	8	3	0	1	14	1
AHPAH	10/25/1995	4	TROUT	CHRISM	0	15.3	1.07	10	10	1	9	0	14	2
AHPAH	10/25/1995	4	TROUT	CHRISM	0	15.3	1.07	10	10	2	1	1	14	2
AHPAH	10/25/1995	4	TROUT	CHRISM	0	15.3	1.07	10	8	3	1	1	14	2
AHPAH	10/26/1995	4	TROUT	CHRISM	5	15.3	1.07	14	12	1	9	0	14	3
AHPAH	10/26/1995	4	TROUT	CHRISM	5	15.3	1.07	14	13	2	2	1	14	3
AHPAH	10/26/1995	4	TROUT	CHRISM	5	15.3	1.07	14	9	3	2	1	14	3
AHPAH	10/24/1995	5	TROUT	GINOSA	15	10.9	0.46	3	0	1	9	0	2	1
AHPAH	10/24/1995	5	TROUT	GINOSA	15	10.9	0.46	3	1	2	0	1	2	1
AHPAH	10/24/1995	5	TROUT	GINOSA	15	10.9	0.46	3	2	3	0	1	2	1
AHPAH	10/25/1995	5	TROUT	GINOSA	0	10.9	0.46	2	2	1	9	0	2	2
AHPAH	10/25/1995	5	TROUT	GINOSA	0	10.9	0.46	2	2	2	1	1	2	2
AHPAH	10/25/1995	5	TROUT	GINOSA	0	10.9	0.46	2	2	3	1	1	2	2
AHPAH	10/26/1995	5	TROUT	GINOSA	5	10.9	0.46	3	1	1	9	0	2	3
AHPAH	10/26/1995	5	TROUT	GINOSA	5	10.9	0.46	3	1	2	2	1	2	3
AHPAH	10/26/1995	5	TROUT	GINOSA	5	10.9	0.46	3	2	3	2	1	2	3

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMA	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
AHPAH	10/24/1995	6	TROUT	CHRISM	15	9.7	0.58	4	4	1	9	0	4	1
AHPAH	10/24/1995	6	TROUT	CHRISM	15	9.7	0.58	4	4	2	0	1	4	1
AHPAH	10/24/1995	6	TROUT	CHRISM	15	9.7	0.58	4	4	3	0	1	4	1
AHPAH	10/25/1995	6	TROUT	CHRISM	0	9.7	0.58	4	3	1	9	0	4	2
AHPAH	10/25/1995	6	TROUT	CHRISM	0	9.7	0.58	4	4	2	1	1	4	2
AHPAH	10/25/1995	6	TROUT	CHRISM	0	9.7	0.58	4	4	3	1	1	4	2
AHPAH	10/26/1995	6	TROUT	CHRISM	5	9.7	0.58	5	4	1	9	0	4	3
AHPAH	10/26/1995	6	TROUT	CHRISM	5	9.7	0.58	5	3	2	2	1	4	3
AHPAH	10/26/1995	6	TROUT	CHRISM	5	9.7	0.58	5	1	3	2	1	4	3
AHPAH	10/24/1995	7	TROUT	HANKBR	5	14.6	0.55	6	4	1	9	0	8	1
AHPAH	10/24/1995	7	TROUT	HANKBR	5	14.6	0.55	6	5	2	2	1	8	1
AHPAH	10/24/1995	7	TROUT	HANKBR	5	14.6	0.55	6	4	3	2	1	8	1
AHPAH	10/25/1995	7	TROUT	HANKBR	15	14.6	0.55	6	6	1	9	0	8	2
AHPAH	10/25/1995	7	TROUT	HANKBR	15	14.6	0.55	6	6	2	0	1	8	2
AHPAH	10/25/1995	7	TROUT	HANKBR	15	14.6	0.55	6	6	3	0	1	8	2
AHPAH	10/26/1995	7	TROUT	HANKBR	0	14.6	0.55	10	4	1	9	0	8	3
AHPAH	10/26/1995	7	TROUT	HANKBR	0	14.6	0.55	10	3	2	1	1	8	3
AHPAH	10/26/1995	7	TROUT	HANKBR	0	14.6	0.55	10	7	3	1	1	8	3
AHPAH	10/26/1995	8	TROUT	CHRISM	15	5.9	0.64	1	1	1	9	0	1	3
AHPAH	10/26/1995	8	TROUT	CHRISM	15	5.9	0.64	1	1	2	0	1	1	3
AHPAH	10/26/1995	8	TROUT	CHRISM	15	5.9	0.64	1	1	3	0	1	1	3
AHPAH	10/24/1995	9	TROUT	GINOSA	5	12.2	0.58	4	1	1	9	0	5	1
AHPAH	10/24/1995	9	TROUT	GINOSA	5	12.2	0.58	4	2	2	2	1	5	1
AHPAH	10/24/1995	9	TROUT	GINOSA	5	12.2	0.58	4	3	3	2	1	5	1
AHPAH	10/25/1995	9	TROUT	GINOSA	15	12.2	0.58	3	3	1	9	0	5	2
AHPAH	10/25/1995	9	TROUT	GINOSA	15	12.2	0.58	3	3	2	0	1	5	2
AHPAH	10/25/1995	9	TROUT	GINOSA	15	12.2	0.58	3	3	3	0	1	5	2
AHPAH	10/26/1995	9	TROUT	GINOSA	0	12.2	0.58	5	2	1	9	0	5	3
AHPAH	10/26/1995	9	TROUT	GINOSA	0	12.2	0.58	5	3	2	1	1	5	3
AHPAH	10/26/1995	9	TROUT	GINOSA	0	12.2	0.58	5	4	3	1	1	5	3
AHPAH	10/24/1995	10	TROUT	CHRISM	0	21.2	0.46	3	0	1	9	0	3	1
AHPAH	10/24/1995	10	TROUT	CHRISM	0	21.2	0.46	3	2	2	1	1	3	1
AHPAH	10/24/1995	10	TROUT	CHRISM	0	21.2	0.46	3	1	3	1	1	3	1
AHPAH	10/25/1995	10	TROUT	CHRISM	5	21.2	0.46	2	1	1	9	0	3	2
AHPAH	10/25/1995	10	TROUT	CHRISM	5	21.2	0.46	2	2	2	2	1	3	2
AHPAH	10/25/1995	10	TROUT	CHRISM	5	21.2	0.46	2	2	3	2	1	3	2
AHPAH	10/26/1995	10	TROUT	CHRISM	15	21.2	0.46	3	3	1	9	0	3	3
AHPAH	10/26/1995	10	TROUT	CHRISM	15	21.2	0.46	3	3	2	0	1	3	3
AHPAH	10/26/1995	10	TROUT	CHRISM	15	21.2	0.46	3	3	3	0	1	3	3
AHPAH	10/24/1995	11	COHO	HANKBR	5	12.5	0.64	9	7	1	9	0	9	1
AHPAH	10/24/1995	11	COHO	HANKBR	5	12.5	0.64	9	7	2	2	1	9	1
AHPAH	10/24/1995	11	COHO	HANKBR	5	12.5	0.64	9	8	3	2	1	9	1
AHPAH	10/25/1995	11	COHO	HANKBR	15	12.5	0.64	6	6	1	9	0	9	2

CREEK	DATE	UNIT	SPP	DIVER	INT	LGTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
AHPAH	10/25/1995	11	COHO	HANKBR	15	12.5	0.64	6	6	2	0	1	9	2
AHPAH	10/25/1995	11	COHO	HANKBR	15	12.5	0.64	6	6	3	0	1	9	2
AHPAH	10/26/1995	11	COHO	HANKBR	0	12.5	0.64	6	6	1	9	0	9	3
AHPAH	10/26/1995	11	COHO	HANKBR	0	12.5	0.64	6	6	2	1	1	9	3
AHPAH	10/26/1995	11	COHO	HANKBR	0	12.5	0.64	6	6	3	1	1	9	3
AHPAH	10/24/1995	11	TROUT	HANKBR	5	12.5	0.64	6	4	1	9	0	7	1
AHPAH	10/24/1995	11	TROUT	HANKBR	5	12.5	0.64	6	4	2	2	1	7	1
AHPAH	10/24/1995	11	TROUT	HANKBR	5	12.5	0.64	6	5	3	2	1	7	1
AHPAH	10/25/1995	11	TROUT	HANKBR	15	12.5	0.64	7	7	1	9	0	7	2
AHPAH	10/25/1995	11	TROUT	HANKBR	15	12.5	0.64	7	7	2	0	1	7	2
AHPAH	10/25/1995	11	TROUT	HANKBR	15	12.5	0.64	7	7	3	0	1	7	2
AHPAH	10/26/1995	11	TROUT	HANKBR	0	12.5	0.64	6	6	1	9	0	7	3
AHPAH	10/26/1995	11	TROUT	HANKBR	0	12.5	0.64	6	5	2	1	1	7	3
AHPAH	10/26/1995	11	TROUT	HANKBR	0	12.5	0.64	6	6	3	1	1	7	3
AHPAH	10/24/1995	12	TROUT	GINOSA	5	14.8	0.52	3	0	1	9	0	7	1
AHPAH	10/24/1995	12	TROUT	GINOSA	5	14.8	0.52	3	3	2	2	1	7	1
AHPAH	10/24/1995	12	TROUT	GINOSA	5	14.8	0.52	3	3	3	2	1	7	1
AHPAH	10/25/1995	12	TROUT	GINOSA	15	14.8	0.52	3	3	1	9	0	7	2
AHPAH	10/25/1995	12	TROUT	GINOSA	15	14.8	0.52	3	3	2	0	1	7	2
AHPAH	10/25/1995	12	TROUT	GINOSA	15	14.8	0.52	3	3	3	0	1	7	2
AHPAH	10/26/1995	12	TROUT	GINOSA	0	14.8	0.52	7	3	1	9	0	7	3
AHPAH	10/26/1995	12	TROUT	GINOSA	0	14.8	0.52	7	3	2	1	1	7	3
AHPAH	10/26/1995	12	TROUT	GINOSA	0	14.8	0.52	7	5	3	1	1	7	3
AHPAH	10/24/1995	13	TROUT	CHRISM	5	4.1	0.61	7	5	1	9	0	6	1
AHPAH	10/24/1995	13	TROUT	CHRISM	5	4.1	0.61	7	6	2	2	1	6	1
AHPAH	10/24/1995	13	TROUT	CHRISM	5	4.1	0.61	7	5	3	2	1	6	1
AHPAH	10/25/1995	13	TROUT	CHRISM	15	4.1	0.61	6	3	1	9	0	6	2
AHPAH	10/25/1995	13	TROUT	CHRISM	15	4.1	0.61	6	6	2	0	1	6	2
AHPAH	10/25/1995	13	TROUT	CHRISM	15	4.1	0.61	6	6	3	0	1	6	2
AHPAH	10/26/1995	13	TROUT	CHRISM	0	4.1	0.61	7	5	1	9	0	6	3
AHPAH	10/26/1995	13	TROUT	CHRISM	0	4.1	0.61	7	5	2	1	1	6	3
AHPAH	10/26/1995	13	TROUT	CHRISM	0	4.1	0.61	7	6	3	1	1	6	3
AHPAH	10/24/1995	14	TROUT	HANKBR	0	6.3	0.85	6	4	1	9	0	8	1
AHPAH	10/24/1995	14	TROUT	HANKBR	0	6.3	0.85	6	6	2	1	1	8	1
AHPAH	10/24/1995	14	TROUT	HANKBR	0	6.3	0.85	6	6	3	1	1	8	1
AHPAH	10/25/1995	14	TROUT	HANKBR	5	6.3	0.85	8	6	1	9	0	8	2
AHPAH	10/25/1995	14	TROUT	HANKBR	5	6.3	0.85	8	8	2	2	1	8	2
AHPAH	10/25/1995	14	TROUT	HANKBR	5	6.3	0.85	8	8	3	2	1	8	2
AHPAH	10/26/1995	14	TROUT	HANKBR	15	6.3	0.85	6	6	1	9	0	8	3
AHPAH	10/26/1995	14	TROUT	HANKBR	15	6.3	0.85	6	6	2	0	1	8	3
AHPAH	10/26/1995	14	TROUT	HANKBR	15	6.3	0.85	6	6	3	0	1	8	3
AHPAH	10/24/1995	15	TROUT	GINOSA	0	16.0	0.49	4	3	1	9	0	6	1
AHPAH	10/24/1995	15	TROUT	GINOSA	0	16.0	0.49	4	0	2	1	1	6	1

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMA	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
AHPAH	10/24/1995	15	TROUT	GINOSA	0	16.0	0.49	4	2	3	1	1	6	1
AHPAH	10/25/1995	15	TROUT	GINOSA	5	16.0	0.49	6	5	1	9	0	6	2
AHPAH	10/25/1995	15	TROUT	GINOSA	5	16.0	0.49	6	4	2	2	1	6	2
AHPAH	10/25/1995	15	TROUT	GINOSA	5	16.0	0.49	6	4	3	2	1	6	2
AHPAH	10/26/1995	15	TROUT	GINOSA	15	16.0	0.49	4	3	1	9	0	6	3
AHPAH	10/26/1995	15	TROUT	GINOSA	15	16.0	0.49	4	4	2	0	1	6	3
AHPAH	10/26/1995	15	TROUT	GINOSA	15	16.0	0.49	4	4	3	0	1	6	3
AHPAH	10/24/1995	16	TROUT	HANKBR	15	6.4	0.52	2	2	1	9	0	3	1
AHPAH	10/24/1995	16	TROUT	HANKBR	15	6.4	0.52	2	2	2	0	1	3	1
AHPAH	10/24/1995	16	TROUT	HANKBR	15	6.4	0.52	2	2	3	0	1	3	1
AHPAH	10/25/1995	16	TROUT	HANKBR	0	6.4	0.52	4	2	1	9	0	3	2
AHPAH	10/25/1995	16	TROUT	HANKBR	0	6.4	0.52	4	3	2	1	1	3	2
AHPAH	10/25/1995	16	TROUT	HANKBR	0	6.4	0.52	4	2	3	1	1	3	2
AHPAH	10/26/1995	16	TROUT	HANKBR	5	6.4	0.52	3	3	1	9	0	3	3
AHPAH	10/26/1995	16	TROUT	HANKBR	5	6.4	0.52	3	3	2	2	1	3	3
AHPAH	10/26/1995	16	TROUT	HANKBR	5	6.4	0.52	3	3	3	2	1	3	3
AHPAH	10/24/1995	17	TROUT	CHRISM	15	16.0	0.61	8	7	1	9	0	7	1
AHPAH	10/24/1995	17	TROUT	CHRISM	15	16.0	0.61	8	6	2	0	1	7	1
AHPAH	10/24/1995	17	TROUT	CHRISM	15	16.0	0.61	8	6	3	0	1	7	1
AHPAH	10/25/1995	17	TROUT	CHRISM	0	16.0	0.61	6	6	1	9	0	7	2
AHPAH	10/25/1995	17	TROUT	CHRISM	0	16.0	0.61	6	6	2	1	1	7	2
AHPAH	10/25/1995	17	TROUT	CHRISM	0	16.0	0.61	6	6	3	1	1	7	2
AHPAH	10/26/1995	17	TROUT	CHRISM	5	16.0	0.61	8	6	1	9	0	7	3
AHPAH	10/26/1995	17	TROUT	CHRISM	5	16.0	0.61	8	5	2	2	1	7	3
AHPAH	10/26/1995	17	TROUT	CHRISM	5	16.0	0.61	8	7	3	2	1	7	3
AHPAH	10/24/1995	18	TROUT	GINOSA	5	11.5	0.91	9	5	1	9	0	7	1
AHPAH	10/24/1995	18	TROUT	GINOSA	5	11.5	0.91	9	4	2	2	1	7	1
AHPAH	10/24/1995	18	TROUT	GINOSA	5	11.5	0.91	9	7	3	2	1	7	1
AHPAH	10/25/1995	18	TROUT	GINOSA	15	11.5	0.91	8	3	1	9	0	7	2
AHPAH	10/25/1995	18	TROUT	GINOSA	15	11.5	0.91	8	6	2	0	1	7	2
AHPAH	10/25/1995	18	TROUT	GINOSA	15	11.5	0.91	8	7	3	0	1	7	2
AHPAH	10/26/1995	18	TROUT	GINOSA	0	11.5	0.91	8	6	1	9	0	7	3
AHPAH	10/26/1995	18	TROUT	GINOSA	0	11.5	0.91	8	5	2	1	1	7	3
AHPAH	10/26/1995	18	TROUT	GINOSA	0	11.5	0.91	8	7	3	1	1	7	3
AHPAH	10/24/1995	19	TROUT	GINOSA	5	25.7	0.70	11	9	1	9	0	10	1
AHPAH	10/24/1995	19	TROUT	GINOSA	5	25.7	0.70	11	3	2	2	1	10	1
AHPAH	10/24/1995	19	TROUT	GINOSA	5	25.7	0.70	11	7	3	2	1	10	1
AHPAH	10/25/1995	19	TROUT	GINOSA	15	25.7	0.70	7	6	1	9	0	10	2
AHPAH	10/25/1995	19	TROUT	GINOSA	15	25.7	0.70	7	7	2	0	1	10	2
AHPAH	10/25/1995	19	TROUT	GINOSA	15	25.7	0.70	7	7	3	0	1	10	2
AHPAH	10/26/1995	19	TROUT	GINOSA	0	25.7	0.70	9	6	1	9	0	10	3
AHPAH	10/26/1995	19	TROUT	GINOSA	0	25.7	0.70	9	7	2	1	1	10	3
AHPAH	10/26/1995	19	TROUT	GINOSA	0	25.7	0.70	9	8	3	1	1	10	3

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
AHPAH	10/24/1995	20	TROUT	HANKBR	0	7.8	0.52	2	1	1	9	0	2	1
AHPAH	10/24/1995	20	TROUT	HANKBR	0	7.8	0.52	2	2	2	1	1	2	1
AHPAH	10/24/1995	20	TROUT	HANKBR	0	7.8	0.52	2	2	3	1	1	2	1
AHPAH	10/25/1995	20	TROUT	HANKBR	5	7.8	0.52	2	2	1	9	0	2	2
AHPAH	10/25/1995	20	TROUT	HANKBR	5	7.8	0.52	2	2	2	2	1	2	2
AHPAH	10/25/1995	20	TROUT	HANKBR	5	7.8	0.52	2	2	3	2	1	2	2
AHPAH	10/26/1995	20	TROUT	HANKBR	15	7.8	0.52	2	2	1	9	0	2	3
AHPAH	10/26/1995	20	TROUT	HANKBR	15	7.8	0.52	2	2	2	0	1	2	3
AHPAH	10/26/1995	20	TROUT	HANKBR	15	7.8	0.52	2	2	3	0	1	2	3
AHPAH	10/24/1995	21	TROUT	CHRISM	0	10.3	0.73	4	3	1	9	0	4	1
AHPAH	10/24/1995	21	TROUT	CHRISM	0	10.3	0.73	4	2	2	1	1	4	1
AHPAH	10/24/1995	21	TROUT	CHRISM	0	10.3	0.73	4	2	3	1	1	4	1
AHPAH	10/25/1995	21	TROUT	CHRISM	5	10.3	0.73	4	3	1	9	0	4	2
AHPAH	10/25/1995	21	TROUT	CHRISM	5	10.3	0.73	4	4	2	2	1	4	2
AHPAH	10/25/1995	21	TROUT	CHRISM	5	10.3	0.73	4	4	3	2	1	4	2
AHPAH	10/26/1995	21	TROUT	CHRISM	15	10.3	0.73	4	4	1	9	0	4	3
AHPAH	10/26/1995	21	TROUT	CHRISM	15	10.3	0.73	4	4	2	0	1	4	3
AHPAH	10/26/1995	21	TROUT	CHRISM	15	10.3	0.73	4	4	3	0	1	4	3
CLARKS	06/05/1996	40	COHO	GREGTA	5	12.1	0.61	6	6	1	9	0	6	1
CLARKS	06/05/1996	40	COHO	GREGTA	5	12.1	0.61	6	5	2	2	1	6	1
CLARKS	06/05/1996	40	COHO	GREGTA	5	12.1	0.61	6	6	3	2	1	6	1
CLARKS	06/06/1996	40	COHO	GREGTA	15	12.1	0.61	6	6	1	9	0	6	2
CLARKS	06/06/1996	40	COHO	GREGTA	15	12.1	0.61	6	6	2	0	1	6	2
CLARKS	06/06/1996	40	COHO	GREGTA	15	12.1	0.61	6	6	3	0	1	6	2
CLARKS	06/07/1996	40	COHO	GREGTA	0	12.1	0.61	4	4	1	9	0	6	3
CLARKS	06/07/1996	40	COHO	GREGTA	0	12.1	0.61	4	4	2	1	1	6	3
CLARKS	06/07/1996	40	COHO	GREGTA	0	12.1	0.61	4	4	3	1	1	6	3
CLARKS	06/05/1996	40	TROUT	GREGTA	5	12.1	0.61	3	3	1	9	0	3	1
CLARKS	06/05/1996	40	TROUT	GREGTA	5	12.1	0.61	3	3	2	2	1	3	1
CLARKS	06/05/1996	40	TROUT	GREGTA	5	12.1	0.61	3	3	3	2	1	3	1
CLARKS	06/06/1996	40	TROUT	GREGTA	15	12.1	0.61	4	2	1	9	0	3	2
CLARKS	06/06/1996	40	TROUT	GREGTA	15	12.1	0.61	4	3	2	0	1	3	2
CLARKS	06/06/1996	40	TROUT	GREGTA	15	12.1	0.61	4	2	3	0	1	3	2
CLARKS	06/07/1996	40	TROUT	GREGTA	0	12.1	0.61	2	2	1	9	0	3	3
CLARKS	06/07/1996	40	TROUT	GREGTA	0	12.1	0.61	2	2	2	1	1	3	3
CLARKS	06/07/1996	40	TROUT	GREGTA	0	12.1	0.61	2	2	3	1	1	3	3
CLARKS	06/05/1996	50	COHO	MIKECR	15	8.4	0.82	4	2	1	9	0	4	1
CLARKS	06/05/1996	50	COHO	MIKECR	15	8.4	0.82	4	3	2	0	1	4	1
CLARKS	06/05/1996	50	COHO	MIKECR	15	8.4	0.82	4	2	3	0	1	4	1
CLARKS	06/05/1996	50	TROUT	MIKECR	15	8.4	0.82	6	4	1	9	0	5	1
CLARKS	06/05/1996	50	TROUT	MIKECR	15	8.4	0.82	6	2	2	0	1	5	1
CLARKS	06/05/1996	50	TROUT	MIKECR	15	8.4	0.82	6	2	3	0	1	5	1
CLARKS	06/06/1996	50	TROUT	MIKECR	0	8.4	0.82	3	2	1	9	0	5	2

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
CLARKS	06/06/1996	50	TROUT	MIKECR	0	8.4	0.82	3	3	2	1	1	5	2
CLARKS	06/06/1996	50	TROUT	MIKECR	0	8.4	0.82	3	3	3	1	1	5	2
CLARKS	06/07/1996	50	TROUT	MIKECR	5	8.4	0.82	1	1	1	9	0	5	3
CLARKS	06/07/1996	50	TROUT	MIKECR	5	8.4	0.82	1	1	2	2	1	5	3
CLARKS	06/07/1996	50	TROUT	MIKECR	5	8.4	0.82	1	1	3	2	1	5	3
CLARKS	06/05/1996	60	COHO	GREGTA	5	10.0	0.75	5	4	1	9	0	5	1
CLARKS	06/05/1996	60	COHO	GREGTA	5	10.0	0.75	5	3	2	2	1	5	1
CLARKS	06/05/1996	60	COHO	GREGTA	5	10.0	0.75	5	3	3	2	1	5	1
CLARKS	06/06/1996	60	COHO	GREGTA	15	10.0	0.75	2	2	1	9	0	5	2
CLARKS	06/06/1996	60	COHO	GREGTA	15	10.0	0.75	2	2	2	0	1	5	2
CLARKS	06/06/1996	60	COHO	GREGTA	15	10.0	0.75	2	2	3	0	1	5	2
CLARKS	06/07/1996	60	COHO	GREGTA	0	10.0	0.75	3	1	1	9	0	5	3
CLARKS	06/07/1996	60	COHO	GREGTA	0	10.0	0.75	3	2	2	1	1	5	3
CLARKS	06/07/1996	60	COHO	GREGTA	0	10.0	0.75	3	1	3	1	1	5	3
CLARKS	06/05/1996	60	TROUT	GREGTA	5	10.0	0.75	3	1	1	9	0	4	1
CLARKS	06/05/1996	60	TROUT	GREGTA	5	10.0	0.75	3	1	2	2	1	4	1
CLARKS	06/05/1996	60	TROUT	GREGTA	5	10.0	0.75	3	2	3	2	1	4	1
CLARKS	06/06/1996	60	TROUT	GREGTA	15	10.0	0.75	4	2	1	9	0	4	2
CLARKS	06/06/1996	60	TROUT	GREGTA	15	10.0	0.75	4	3	2	0	1	4	2
CLARKS	06/06/1996	60	TROUT	GREGTA	15	10.0	0.75	4	2	3	0	1	4	2
CLARKS	06/07/1996	60	TROUT	GREGTA	0	10.0	0.75	2	2	1	9	0	4	3
CLARKS	06/07/1996	60	TROUT	GREGTA	0	10.0	0.75	2	2	2	1	1	4	3
CLARKS	06/07/1996	60	TROUT	GREGTA	0	10.0	0.75	2	1	3	1	1	4	3
CLARKS	06/05/1996	70	COHO	MIKECR	5	6.6	0.67	3	1	1	9	0	3	1
CLARKS	06/05/1996	70	COHO	MIKECR	5	6.6	0.67	3	1	2	2	1	3	1
CLARKS	06/05/1996	70	COHO	MIKECR	5	6.6	0.67	3	2	3	2	1	3	1
CLARKS	06/06/1996	70	COHO	MIKECR	15	6.6	0.67	2	0	1	9	0	3	2
CLARKS	06/06/1996	70	COHO	MIKECR	15	6.6	0.67	2	0	2	0	1	3	2
CLARKS	06/06/1996	70	COHO	MIKECR	15	6.6	0.67	2	1	3	0	1	3	2
CLARKS	06/07/1996	70	COHO	MIKECR	0	6.6	0.67	1	1	1	9	0	3	3
CLARKS	06/07/1996	70	COHO	MIKECR	0	6.6	0.67	1	1	2	1	1	3	3
CLARKS	06/07/1996	70	COHO	MIKECR	0	6.6	0.67	1	1	3	1	1	3	3
CLARKS	06/05/1996	70	TROUT	MIKECR	5	6.6	0.67	2	1	1	9	0	2	1
CLARKS	06/05/1996	70	TROUT	MIKECR	5	6.6	0.67	2	2	2	2	1	2	1
CLARKS	06/05/1996	70	TROUT	MIKECR	5	6.6	0.67	2	2	3	2	1	2	1
CLARKS	06/06/1996	70	TROUT	MIKECR	15	6.6	0.67	1	1	1	9	0	2	2
CLARKS	06/06/1996	70	TROUT	MIKECR	15	6.6	0.67	1	1	2	0	1	2	2
CLARKS	06/06/1996	70	TROUT	MIKECR	15	6.6	0.67	1	1	3	0	1	2	2
CLARKS	06/07/1996	70	TROUT	MIKECR	0	6.6	0.67	3	1	1	9	0	2	3
CLARKS	06/07/1996	70	TROUT	MIKECR	0	6.6	0.67	3	1	2	1	1	2	3
CLARKS	06/07/1996	70	TROUT	MIKECR	0	6.6	0.67	3	2	3	1	1	2	3
CLARKS	06/05/1996	90	COHO	GREGTA	15	8.1	0.49	4	0	1	9	0	4	1
CLARKS	06/05/1996	90	COHO	GREGTA	15	8.1	0.49	4	2	2	0	1	4	1

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
CLARKS	06/05/1996	90	COHO	GREGTA	15	8.1	0.49	4	0	3	0	1	4	1
CLARKS	06/06/1996	90	COHO	GREGTA	0	8.1	0.49	4	2	1	9	0	4	2
CLARKS	06/06/1996	90	COHO	GREGTA	0	8.1	0.49	4	3	2	1	1	4	2
CLARKS	06/06/1996	90	COHO	GREGTA	0	8.1	0.49	4	2	3	1	1	4	2
CLARKS	06/07/1996	90	COHO	GREGTA	5	8.1	0.49	2	2	1	9	0	4	3
CLARKS	06/07/1996	90	COHO	GREGTA	5	8.1	0.49	2	2	2	2	1	4	3
CLARKS	06/07/1996	90	COHO	GREGTA	5	8.1	0.49	2	1	3	2	1	4	3
CLARKS	06/05/1996	90	TROUT	GREGTA	15	8.1	0.49	2	2	1	9	0	3	1
CLARKS	06/05/1996	90	TROUT	GREGTA	15	8.1	0.49	2	2	2	0	1	3	1
CLARKS	06/05/1996	90	TROUT	GREGTA	15	8.1	0.49	2	2	3	0	1	3	1
CLARKS	06/06/1996	90	TROUT	GREGTA	0	8.1	0.49	4	2	1	9	0	3	2
CLARKS	06/06/1996	90	TROUT	GREGTA	0	8.1	0.49	4	2	2	1	1	3	2
CLARKS	06/06/1996	90	TROUT	GREGTA	0	8.1	0.49	4	3	3	1	1	3	2
CLARKS	06/07/1996	90	TROUT	GREGTA	5	8.1	0.49	4	3	1	9	0	3	3
CLARKS	06/07/1996	90	TROUT	GREGTA	5	8.1	0.49	4	2	2	2	1	3	3
CLARKS	06/07/1996	90	TROUT	GREGTA	5	8.1	0.49	4	2	3	2	1	3	3
CLARKS	06/05/1996	100	TROUT	MIKECR	5	15.5	0.55	4	0	1	9	0	3	1
CLARKS	06/05/1996	100	TROUT	MIKECR	5	15.5	0.55	4	2	2	2	1	3	1
CLARKS	06/05/1996	100	TROUT	MIKECR	5	15.5	0.55	4	0	3	2	1	3	1
CLARKS	06/06/1996	100	TROUT	MIKECR	15	15.5	0.55	1	1	1	9	0	3	2
CLARKS	06/06/1996	100	TROUT	MIKECR	15	15.5	0.55	1	1	2	0	1	3	2
CLARKS	06/06/1996	100	TROUT	MIKECR	15	15.5	0.55	1	1	3	0	1	3	2
CLARKS	06/07/1996	100	TROUT	MIKECR	0	15.5	0.55	1	0	1	9	0	3	3
CLARKS	06/07/1996	100	TROUT	MIKECR	0	15.5	0.55	1	1	2	1	1	3	3
CLARKS	06/07/1996	100	TROUT	MIKECR	0	15.5	0.55	1	1	3	1	1	3	3
CLARKS	06/05/1996	110	COHO	GREGTA	0	11.3	0.64	1	1	1	9	0	1	1
CLARKS	06/05/1996	110	COHO	GREGTA	0	11.3	0.64	1	1	2	1	1	1	1
CLARKS	06/05/1996	110	COHO	GREGTA	0	11.3	0.64	1	0	3	1	1	1	1
CLARKS	06/05/1996	110	TROUT	GREGTA	0	11.3	0.64	4	3	1	9	0	5	1
CLARKS	06/05/1996	110	TROUT	GREGTA	0	11.3	0.64	4	4	2	1	1	5	1
CLARKS	06/05/1996	110	TROUT	GREGTA	0	11.3	0.64	4	4	3	1	1	5	1
CLARKS	06/06/1996	110	TROUT	GREGTA	5	11.3	0.64	3	3	1	9	0	5	2
CLARKS	06/06/1996	110	TROUT	GREGTA	5	11.3	0.64	3	3	2	2	1	5	2
CLARKS	06/06/1996	110	TROUT	GREGTA	5	11.3	0.64	3	3	3	2	1	5	2
CLARKS	06/07/1996	110	TROUT	GREGTA	15	11.3	0.64	5	4	1	9	0	5	3
CLARKS	06/07/1996	110	TROUT	GREGTA	15	11.3	0.64	5	5	2	0	1	5	3
CLARKS	06/07/1996	110	TROUT	GREGTA	15	11.3	0.64	5	5	3	0	1	5	3
CLARKS	06/05/1996	120	COHO	MIKECR	15	28.1	0.91	2	0	1	9	0	1	1
CLARKS	06/05/1996	120	COHO	MIKECR	15	28.1	0.91	2	1	2	0	1	1	1
CLARKS	06/05/1996	120	COHO	MIKECR	15	28.1	0.91	2	0	3	0	1	1	1
CLARKS	06/07/1996	120	COHO	MIKECR	5	28.1	0.91	1	1	1	9	0	1	3
CLARKS	06/07/1996	120	COHO	MIKECR	5	28.1	0.91	1	0	2	2	1	1	3
CLARKS	06/07/1996	120	COHO	MIKECR	5	28.1	0.91	1	1	3	2	1	1	3

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
CLARKS	06/05/1996	120	TROUT	MIKECR	15	28.1	0.91	3	2	1	9	0	3	1
CLARKS	06/05/1996	120	TROUT	MIKECR	15	28.1	0.91	3	3	2	0	1	3	1
CLARKS	06/05/1996	120	TROUT	MIKECR	15	28.1	0.91	3	3	3	0	1	3	1
CLARKS	06/06/1996	120	TROUT	MIKECR	0	28.1	0.91	2	2	1	9	0	3	2
CLARKS	06/06/1996	120	TROUT	MIKECR	0	28.1	0.91	2	2	2	1	1	3	2
CLARKS	06/06/1996	120	TROUT	MIKECR	0	28.1	0.91	2	2	3	1	1	3	2
CLARKS	06/07/1996	120	TROUT	MIKECR	5	28.1	0.91	2	2	1	9	0	3	3
CLARKS	06/07/1996	120	TROUT	MIKECR	5	28.1	0.91	2	1	2	2	1	3	3
CLARKS	06/07/1996	120	TROUT	MIKECR	5	28.1	0.91	2	2	3	2	1	3	3
CLARKS	06/05/1996	130	TROUT	GREGTA	5	12.0	0.99	1	1	1	9	0	4	1
CLARKS	06/05/1996	130	TROUT	GREGTA	5	12.0	0.99	1	1	2	2	1	4	1
CLARKS	06/05/1996	130	TROUT	GREGTA	5	12.0	0.99	1	1	3	2	1	4	1
CLARKS	06/06/1996	130	TROUT	GREGTA	15	12.0	0.99	1	1	1	9	0	4	2
CLARKS	06/06/1996	130	TROUT	GREGTA	15	12.0	0.99	1	1	2	0	1	4	2
CLARKS	06/06/1996	130	TROUT	GREGTA	15	12.0	0.99	1	1	3	0	1	4	2
CLARKS	06/07/1996	130	TROUT	GREGTA	0	12.0	0.99	4	2	1	9	0	4	3
CLARKS	06/07/1996	130	TROUT	GREGTA	0	12.0	0.99	4	3	2	1	1	4	3
CLARKS	06/07/1996	130	TROUT	GREGTA	0	12.0	0.99	4	2	3	1	1	4	3
CLARKS	06/06/1996	150	TROUT	MIKECR	5	23.7	0.43	1	0	1	9	0	1	2
CLARKS	06/06/1996	150	TROUT	MIKECR	5	23.7	0.43	1	1	2	2	1	1	2
CLARKS	06/06/1996	150	TROUT	MIKECR	5	23.7	0.43	1	1	3	2	1	1	2
CLARKS	06/05/1996	160	TROUT	GREGTA	15	19.1	0.55	1	1	1	9	0	3	1
CLARKS	06/05/1996	160	TROUT	GREGTA	15	19.1	0.55	1	1	2	0	1	3	1
CLARKS	06/05/1996	160	TROUT	GREGTA	15	19.1	0.55	1	1	3	0	1	3	1
CLARKS	06/06/1996	160	TROUT	GREGTA	0	19.1	0.55	1	1	1	9	0	3	2
CLARKS	06/06/1996	160	TROUT	GREGTA	0	19.1	0.55	1	1	2	1	1	3	2
CLARKS	06/06/1996	160	TROUT	GREGTA	0	19.1	0.55	1	0	3	1	1	3	2
CLARKS	06/07/1996	160	TROUT	GREGTA	5	19.1	0.55	3	3	1	9	0	3	3
CLARKS	06/07/1996	160	TROUT	GREGTA	5	19.1	0.55	3	3	2	2	1	3	3
CLARKS	06/07/1996	160	TROUT	GREGTA	5	19.1	0.55	3	1	3	2	1	3	3
CLARKS	06/05/1996	180	COHO	MIKECR	0	10.8	0.76	1	0	1	9	0	3	1
CLARKS	06/05/1996	180	COHO	MIKECR	0	10.8	0.76	1	1	2	1	1	3	1
CLARKS	06/05/1996	180	COHO	MIKECR	0	10.8	0.76	1	1	3	1	1	3	1
CLARKS	06/06/1996	180	COHO	MIKECR	5	10.8	0.76	1	1	1	9	0	3	2
CLARKS	06/06/1996	180	COHO	MIKECR	5	10.8	0.76	1	1	2	2	1	3	2
CLARKS	06/06/1996	180	COHO	MIKECR	5	10.8	0.76	1	1	3	2	1	3	2
CLARKS	06/07/1996	180	COHO	MIKECR	15	10.8	0.76	3	2	1	9	0	3	3
CLARKS	06/07/1996	180	COHO	MIKECR	15	10.8	0.76	3	1	2	0	1	3	3
CLARKS	06/07/1996	180	COHO	MIKECR	15	10.8	0.76	3	1	3	0	1	3	3
CLARKS	06/05/1996	180	TROUT	MIKECR	0	10.8	0.76	3	1	1	9	0	3	1
CLARKS	06/05/1996	180	TROUT	MIKECR	0	10.8	0.76	3	2	2	1	1	3	1
CLARKS	06/05/1996	180	TROUT	MIKECR	0	10.8	0.76	3	1	3	1	1	3	1
CLARKS	06/06/1996	180	TROUT	MIKECR	5	10.8	0.76	1	1	1	9	0	3	2

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMA	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
CLARKS	06/06/1996	180	TROUT	MIKECR	5	10.8	0.76	1	1	2	2	1	3	2
CLARKS	06/06/1996	180	TROUT	MIKECR	5	10.8	0.76	1	1	3	2	1	3	2
CLARKS	06/07/1996	180	TROUT	MIKECR	15	10.8	0.76	1	0	1	9	0	3	3
CLARKS	06/07/1996	180	TROUT	MIKECR	15	10.8	0.76	1	1	2	0	1	3	3
CLARKS	06/07/1996	180	TROUT	MIKECR	15	10.8	0.76	1	1	3	0	1	3	3
WESTMILL	06/11/1996	1000	COHO	MIKECR	15	49.7	0.90	46	31	1	9	0	70	1
WESTMILL	06/11/1996	1000	COHO	MIKECR	15	49.7	0.90	46	40	2	0	1	70	1
WESTMILL	06/11/1996	1000	COHO	MIKECR	15	49.7	0.90	46	34	3	0	1	70	1
WESTMILL	06/12/1996	1000	COHO	MIKECR	0	49.7	0.90	70	66	1	9	0	70	2
WESTMILL	06/12/1996	1000	COHO	MIKECR	0	49.7	0.90	70	62	2	1	1	70	2
WESTMILL	06/12/1996	1000	COHO	MIKECR	0	49.7	0.90	70	53	3	1	1	70	2
WESTMILL	06/13/1996	1000	COHO	MIKECR	5	49.7	0.90	55	54	1	9	0	70	3
WESTMILL	06/13/1996	1000	COHO	MIKECR	5	49.7	0.90	55	51	2	2	1	70	3
WESTMILL	06/13/1996	1000	COHO	MIKECR	5	49.7	0.90	55	53	3	2	1	70	3
WESTMILL	06/11/1996	1000	TROUT	MIKECR	15	49.7	0.90	44	34	1	9	0	45	1
WESTMILL	06/11/1996	1000	TROUT	MIKECR	15	49.7	0.90	44	33	2	0	1	45	1
WESTMILL	06/11/1996	1000	TROUT	MIKECR	15	49.7	0.90	44	39	3	0	1	45	1
WESTMILL	06/12/1996	1000	TROUT	MIKECR	0	49.7	0.90	24	22	1	9	0	45	2
WESTMILL	06/12/1996	1000	TROUT	MIKECR	0	49.7	0.90	24	20	2	1	1	45	2
WESTMILL	06/12/1996	1000	TROUT	MIKECR	0	49.7	0.90	24	19	3	1	1	45	2
WESTMILL	06/13/1996	1000	TROUT	MIKECR	5	49.7	0.90	11	8	1	9	0	45	3
WESTMILL	06/13/1996	1000	TROUT	MIKECR	5	49.7	0.90	11	9	2	2	1	45	3
WESTMILL	06/13/1996	1000	TROUT	MIKECR	5	49.7	0.90	11	10	3	2	1	45	3
WESTMILL	06/11/1996	2000	COHO	JAMESR	5	22.7	1.04	44	37	1	9	0	54	1
WESTMILL	06/11/1996	2000	COHO	JAMESR	5	22.7	1.04	44	22	2	2	1	54	1
WESTMILL	06/11/1996	2000	COHO	JAMESR	5	22.7	1.04	44	30	3	2	1	54	1
WESTMILL	06/12/1996	2000	COHO	JAMESR	15	22.7	1.04	61	35	1	9	0	54	2
WESTMILL	06/12/1996	2000	COHO	JAMESR	15	22.7	1.04	61	41	2	0	1	54	2
WESTMILL	06/12/1996	2000	COHO	JAMESR	15	22.7	1.04	61	51	3	0	1	54	2
WESTMILL	06/13/1996	2000	COHO	JAMESR	0	22.7	1.04	49	47	1	9	0	54	3
WESTMILL	06/13/1996	2000	COHO	JAMESR	0	22.7	1.04	49	48	2	1	1	54	3
WESTMILL	06/13/1996	2000	COHO	JAMESR	0	22.7	1.04	49	38	3	1	1	54	3
WESTMILL	06/11/1996	2000	TROUT	JAMESR	5	22.7	1.04	10	7	1	9	0	12	1
WESTMILL	06/11/1996	2000	TROUT	JAMESR	5	22.7	1.04	10	8	2	2	1	12	1
WESTMILL	06/11/1996	2000	TROUT	JAMESR	5	22.7	1.04	10	9	3	2	1	12	1
WESTMILL	06/12/1996	2000	TROUT	JAMESR	15	22.7	1.04	12	12	1	9	0	12	2
WESTMILL	06/12/1996	2000	TROUT	JAMESR	15	22.7	1.04	12	12	2	0	1	12	2
WESTMILL	06/12/1996	2000	TROUT	JAMESR	15	22.7	1.04	12	9	3	0	1	12	2
WESTMILL	06/13/1996	2000	TROUT	JAMESR	0	22.7	1.04	14	12	1	9	0	12	3
WESTMILL	06/13/1996	2000	TROUT	JAMESR	0	22.7	1.04	14	10	2	1	1	12	3
WESTMILL	06/13/1996	2000	TROUT	JAMESR	0	22.7	1.04	14	7	3	1	1	12	3
WESTMILL	06/11/1996	3000	COHO	TIMHAY	0	49.5	1.31	178	146	1	9	0	178	1
WESTMILL	06/11/1996	3000	COHO	TIMHAY	0	49.5	1.31	178	144	2	1	1	178	1

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
WESTMILL	06/11/1996	3000	COHO	TIMHAY	0	49.5	1.31	178	162	3	1	1	178	1
WESTMILL	06/12/1996	3000	COHO	TIMHAY	5	49.5	1.31	185	137	1	9	0	178	2
WESTMILL	06/12/1996	3000	COHO	TIMHAY	5	49.5	1.31	185	155	2	2	1	178	2
WESTMILL	06/12/1996	3000	COHO	TIMHAY	5	49.5	1.31	185	170	3	2	1	178	2
WESTMILL	06/13/1996	3000	COHO	TIMHAY	15	49.5	1.31	152	146	1	9	0	178	3
WESTMILL	06/13/1996	3000	COHO	TIMHAY	15	49.5	1.31	152	151	2	0	1	178	3
WESTMILL	06/13/1996	3000	COHO	TIMHAY	15	49.5	1.31	152	150	3	0	1	178	3
WESTMILL	06/11/1996	3000	TROUT	TIMHAY	0	49.5	1.31	45	22	1	9	0	37	1
WESTMILL	06/11/1996	3000	TROUT	TIMHAY	0	49.5	1.31	45	23	2	1	1	37	1
WESTMILL	06/11/1996	3000	TROUT	TIMHAY	0	49.5	1.31	45	34	3	1	1	37	1
WESTMILL	06/12/1996	3000	TROUT	TIMHAY	5	49.5	1.31	42	30	1	9	0	37	2
WESTMILL	06/12/1996	3000	TROUT	TIMHAY	5	49.5	1.31	42	28	2	2	1	37	2
WESTMILL	06/12/1996	3000	TROUT	TIMHAY	5	49.5	1.31	42	36	3	2	1	37	2
WESTMILL	06/13/1996	3000	TROUT	TIMHAY	15	49.5	1.31	39	29	1	9	0	37	3
WESTMILL	06/13/1996	3000	TROUT	TIMHAY	15	49.5	1.31	39	31	2	0	1	37	3
WESTMILL	06/13/1996	3000	TROUT	TIMHAY	15	49.5	1.31	39	35	3	0	1	37	3
WESTMILL	06/11/1996	4000	COHO	MIKECR	5	50.8	1.28	117	81	1	9	0	123	1
WESTMILL	06/11/1996	4000	COHO	MIKECR	5	50.8	1.28	117	93	2	2	1	123	1
WESTMILL	06/11/1996	4000	COHO	MIKECR	5	50.8	1.28	117	105	3	2	1	123	1
WESTMILL	06/12/1996	4000	COHO	MIKECR	15	50.8	1.28	128	114	1	9	0	123	2
WESTMILL	06/12/1996	4000	COHO	MIKECR	15	50.8	1.28	128	84	2	0	1	123	2
WESTMILL	06/12/1996	4000	COHO	MIKECR	15	50.8	1.28	128	100	3	0	1	123	2
WESTMILL	06/13/1996	4000	COHO	MIKECR	0	50.8	1.28	105	82	1	9	0	123	3
WESTMILL	06/13/1996	4000	COHO	MIKECR	0	50.8	1.28	105	96	2	1	1	123	3
WESTMILL	06/13/1996	4000	COHO	MIKECR	0	50.8	1.28	105	87	3	1	1	123	3
WESTMILL	06/11/1996	4000	TROUT	MIKECR	5	50.8	1.28	31	25	1	9	0	31	1
WESTMILL	06/11/1996	4000	TROUT	MIKECR	5	50.8	1.28	31	19	2	2	1	31	1
WESTMILL	06/11/1996	4000	TROUT	MIKECR	5	50.8	1.28	31	16	3	2	1	31	1
WESTMILL	06/12/1996	4000	TROUT	MIKECR	15	50.8	1.28	21	16	1	9	0	31	2
WESTMILL	06/12/1996	4000	TROUT	MIKECR	15	50.8	1.28	21	8	2	0	1	31	2
WESTMILL	06/12/1996	4000	TROUT	MIKECR	15	50.8	1.28	21	11	3	0	1	31	2
WESTMILL	06/13/1996	4000	TROUT	MIKECR	0	50.8	1.28	13	10	1	9	0	31	3
WESTMILL	06/13/1996	4000	TROUT	MIKECR	0	50.8	1.28	13	11	2	1	1	31	3
WESTMILL	06/13/1996	4000	TROUT	MIKECR	0	50.8	1.28	13	12	3	1	1	31	3
WESTMILL	06/11/1996	5000	COHO	JAMESR	5	24.8	1.10	108	72	1	9	0	123	1
WESTMILL	06/11/1996	5000	COHO	JAMESR	5	24.8	1.10	108	82	2	2	1	123	1
WESTMILL	06/11/1996	5000	COHO	JAMESR	5	24.8	1.10	108	95	3	2	1	123	1
WESTMILL	06/12/1996	5000	COHO	JAMESR	15	24.8	1.10	117	84	1	9	0	123	2
WESTMILL	06/12/1996	5000	COHO	JAMESR	15	24.8	1.10	117	93	2	0	1	123	2
WESTMILL	06/12/1996	5000	COHO	JAMESR	15	24.8	1.10	117	105	3	0	1	123	2
WESTMILL	06/13/1996	5000	COHO	JAMESR	0	24.8	1.10	128	100	1	9	0	123	3
WESTMILL	06/13/1996	5000	COHO	JAMESR	0	24.8	1.10	128	114	2	1	1	123	3
WESTMILL	06/13/1996	5000	COHO	JAMESR	0	24.8	1.10	128	99	3	1	1	123	3

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
WESTMILL	06/11/1996	5000	TROUT	JAMESR	5	24.8	1.10	26	15	1	9	0	29	1
WESTMILL	06/11/1996	5000	TROUT	JAMESR	5	24.8	1.10	26	24	2	2	1	29	1
WESTMILL	06/11/1996	5000	TROUT	JAMESR	5	24.8	1.10	26	25	3	2	1	29	1
WESTMILL	06/12/1996	5000	TROUT	JAMESR	15	24.8	1.10	24	22	1	9	0	29	2
WESTMILL	06/12/1996	5000	TROUT	JAMESR	15	24.8	1.10	24	24	2	0	1	29	2
WESTMILL	06/12/1996	5000	TROUT	JAMESR	15	24.8	1.10	24	24	3	0	1	29	2
WESTMILL	06/13/1996	5000	TROUT	JAMESR	0	24.8	1.10	29	23	1	9	0	29	3
WESTMILL	06/13/1996	5000	TROUT	JAMESR	0	24.8	1.10	29	28	2	1	1	29	3
WESTMILL	06/13/1996	5000	TROUT	JAMESR	0	24.8	1.10	29	27	3	1	1	29	3
WESTMILL	06/11/1996	6000	COHO	TIMHAY	5	30.6	1.16	139	93	1	9	0	139	1
WESTMILL	06/11/1996	6000	COHO	TIMHAY	5	30.6	1.16	139	116	2	2	1	139	1
WESTMILL	06/11/1996	6000	COHO	TIMHAY	5	30.6	1.16	139	92	3	2	1	139	1
WESTMILL	06/12/1996	6000	COHO	TIMHAY	15	30.6	1.16	86	80	1	9	0	139	2
WESTMILL	06/12/1996	6000	COHO	TIMHAY	15	30.6	1.16	86	82	2	0	1	139	2
WESTMILL	06/12/1996	6000	COHO	TIMHAY	15	30.6	1.16	86	84	3	0	1	139	2
WESTMILL	06/13/1996	6000	COHO	TIMHAY	0	30.6	1.16	107	77	1	9	0	139	3
WESTMILL	06/13/1996	6000	COHO	TIMHAY	0	30.6	1.16	107	92	2	1	1	139	3
WESTMILL	06/13/1996	6000	COHO	TIMHAY	0	30.6	1.16	107	75	3	1	1	139	3
WESTMILL	06/11/1996	6000	TROUT	TIMHAY	5	30.6	1.16	27	15	1	9	0	34	1
WESTMILL	06/11/1996	6000	TROUT	TIMHAY	5	30.6	1.16	27	26	2	2	1	34	1
WESTMILL	06/11/1996	6000	TROUT	TIMHAY	5	30.6	1.16	27	25	3	2	1	34	1
WESTMILL	06/12/1996	6000	TROUT	TIMHAY	15	30.6	1.16	23	23	1	9	0	34	2
WESTMILL	06/12/1996	6000	TROUT	TIMHAY	15	30.6	1.16	23	22	2	0	1	34	2
WESTMILL	06/12/1996	6000	TROUT	TIMHAY	15	30.6	1.16	23	23	3	0	1	34	2
WESTMILL	06/13/1996	6000	TROUT	TIMHAY	0	30.6	1.16	34	29	1	9	0	34	3
WESTMILL	06/13/1996	6000	TROUT	TIMHAY	0	30.6	1.16	34	32	2	1	1	34	3
WESTMILL	06/13/1996	6000	TROUT	TIMHAY	0	30.6	1.16	34	30	3	1	1	34	3
WESTMILL	06/11/1996	7000	COHO	MIKECR	0	37.7	1.04	66	61	1	9	0	66	1
WESTMILL	06/11/1996	7000	COHO	MIKECR	0	37.7	1.04	66	56	2	1	1	66	1
WESTMILL	06/11/1996	7000	COHO	MIKECR	0	37.7	1.04	66	50	3	1	1	66	1
WESTMILL	06/12/1996	7000	COHO	MIKECR	5	37.7	1.04	39	30	1	9	0	66	2
WESTMILL	06/12/1996	7000	COHO	MIKECR	5	37.7	1.04	39	38	2	2	1	66	2
WESTMILL	06/12/1996	7000	COHO	MIKECR	5	37.7	1.04	39	37	3	2	1	66	2
WESTMILL	06/13/1996	7000	COHO	MIKECR	15	37.7	1.04	46	38	1	9	0	66	3
WESTMILL	06/13/1996	7000	COHO	MIKECR	15	37.7	1.04	46	42	2	0	1	66	3
WESTMILL	06/13/1996	7000	COHO	MIKECR	15	37.7	1.04	46	35	3	0	1	66	3
WESTMILL	06/11/1996	7000	TROUT	MIKECR	0	37.7	1.04	28	28	1	9	0	28	1
WESTMILL	06/11/1996	7000	TROUT	MIKECR	0	37.7	1.04	28	28	2	1	1	28	1
WESTMILL	06/11/1996	7000	TROUT	MIKECR	0	37.7	1.04	28	26	3	1	1	28	1
WESTMILL	06/12/1996	7000	TROUT	MIKECR	5	37.7	1.04	17	9	1	9	0	28	2
WESTMILL	06/12/1996	7000	TROUT	MIKECR	5	37.7	1.04	17	11	2	2	1	28	2
WESTMILL	06/12/1996	7000	TROUT	MIKECR	5	37.7	1.04	17	14	3	2	1	28	2
WESTMILL	06/13/1996	7000	TROUT	MIKECR	15	37.7	1.04	11	7	1	9	0	28	3

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
WESTMILL	06/13/1996	7000	TROUT	MIKECR	15	37.7	1.04	11	9	2	0	1	28	3
WESTMILL	06/13/1996	7000	TROUT	MIKECR	15	37.7	1.04	11	6	3	0	1	28	3
WESTMILL	06/11/1996	8000	COHO	JAMESR	0	53.0	0.98	85	79	1	9	0	108	1
WESTMILL	06/11/1996	8000	COHO	JAMESR	0	53.0	0.98	85	85	2	1	1	108	1
WESTMILL	06/11/1996	8000	COHO	JAMESR	0	53.0	0.98	85	85	3	1	1	108	1
WESTMILL	06/12/1996	8000	COHO	JAMESR	5	53.0	0.98	108	100	1	9	0	108	2
WESTMILL	06/12/1996	8000	COHO	JAMESR	5	53.0	0.98	108	107	2	2	1	108	2
WESTMILL	06/12/1996	8000	COHO	JAMESR	5	53.0	0.98	108	106	3	2	1	108	2
WESTMILL	06/13/1996	8000	COHO	JAMESR	15	53.0	0.98	109	106	1	9	0	108	3
WESTMILL	06/13/1996	8000	COHO	JAMESR	15	53.0	0.98	109	103	2	0	1	108	3
WESTMILL	06/13/1996	8000	COHO	JAMESR	15	53.0	0.98	109	96	3	0	1	108	3
WESTMILL	06/11/1996	8000	TROUT	JAMESR	0	53.0	0.98	45	29	1	9	0	45	1
WESTMILL	06/11/1996	8000	TROUT	JAMESR	0	53.0	0.98	45	37	2	1	1	45	1
WESTMILL	06/11/1996	8000	TROUT	JAMESR	0	53.0	0.98	45	29	3	1	1	45	1
WESTMILL	06/12/1996	8000	TROUT	JAMESR	5	53.0	0.98	29	28	1	9	0	45	2
WESTMILL	06/12/1996	8000	TROUT	JAMESR	5	53.0	0.98	29	22	2	2	1	45	2
WESTMILL	06/12/1996	8000	TROUT	JAMESR	5	53.0	0.98	29	27	3	2	1	45	2
WESTMILL	06/13/1996	8000	TROUT	JAMESR	15	53.0	0.98	32	29	1	9	0	45	3
WESTMILL	06/13/1996	8000	TROUT	JAMESR	15	53.0	0.98	32	26	2	0	1	45	3
WESTMILL	06/13/1996	8000	TROUT	JAMESR	15	53.0	0.98	32	20	3	0	1	45	3
WESTMILL	06/11/1996	9000	COHO	TIMHAY	5	15.5	1.07	55	39	1	9	0	65	1
WESTMILL	06/11/1996	9000	COHO	TIMHAY	5	15.5	1.07	55	50	2	2	1	65	1
WESTMILL	06/11/1996	9000	COHO	TIMHAY	5	15.5	1.07	55	45	3	2	1	65	1
WESTMILL	06/12/1996	9000	COHO	TIMHAY	15	15.5	1.07	57	46	1	9	0	65	2
WESTMILL	06/12/1996	9000	COHO	TIMHAY	15	15.5	1.07	57	55	2	0	1	65	2
WESTMILL	06/12/1996	9000	COHO	TIMHAY	15	15.5	1.07	57	53	3	0	1	65	2
WESTMILL	06/13/1996	9000	COHO	TIMHAY	0	15.5	1.07	65	58	1	9	0	65	3
WESTMILL	06/13/1996	9000	COHO	TIMHAY	0	15.5	1.07	65	63	2	1	1	65	3
WESTMILL	06/13/1996	9000	COHO	TIMHAY	0	15.5	1.07	65	64	3	1	1	65	3
WESTMILL	06/11/1996	9000	TROUT	TIMHAY	5	15.5	1.07	40	12	1	9	0	28	1
WESTMILL	06/11/1996	9000	TROUT	TIMHAY	5	15.5	1.07	40	14	2	2	1	28	1
WESTMILL	06/11/1996	9000	TROUT	TIMHAY	5	15.5	1.07	40	27	3	2	1	28	1
WESTMILL	06/12/1996	9000	TROUT	TIMHAY	15	15.5	1.07	26	24	1	9	0	28	2
WESTMILL	06/12/1996	9000	TROUT	TIMHAY	15	15.5	1.07	26	25	2	0	1	28	2
WESTMILL	06/12/1996	9000	TROUT	TIMHAY	15	15.5	1.07	26	21	3	0	1	28	2
WESTMILL	06/13/1996	9000	TROUT	TIMHAY	0	15.5	1.07	26	26	1	9	0	28	3
WESTMILL	06/13/1996	9000	TROUT	TIMHAY	0	15.5	1.07	26	25	2	1	1	28	3
WESTMILL	06/13/1996	9000	TROUT	TIMHAY	0	15.5	1.07	26	26	3	1	1	28	3
WESTMILL	06/11/1996	10000	COHO	MIKECR	5	40.9	1.28	112	85	1	9	0	124	1
WESTMILL	06/11/1996	10000	COHO	MIKECR	5	40.9	1.28	112	102	2	2	1	124	1
WESTMILL	06/11/1996	10000	COHO	MIKECR	5	40.9	1.28	112	92	3	2	1	124	1
WESTMILL	06/12/1996	10000	COHO	MIKECR	15	40.9	1.28	124	108	1	9	0	124	2
WESTMILL	06/12/1996	10000	COHO	MIKECR	15	40.9	1.28	124	92	2	0	1	124	2

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
WESTMILL	06/12/1996	10000	COHO	MIKECR	15	40.9	1.28	124	116	3	0	1	124	2
WESTMILL	06/13/1996	10000	COHO	MIKECR	0	40.9	1.28	102	76	1	9	0	124	3
WESTMILL	06/13/1996	10000	COHO	MIKECR	0	40.9	1.28	102	90	2	1	1	124	3
WESTMILL	06/13/1996	10000	COHO	MIKECR	0	40.9	1.28	102	78	3	1	1	124	3
WESTMILL	06/11/1996	10000	TROUT	MIKECR	5	40.9	1.28	23	18	1	9	0	23	1
WESTMILL	06/11/1996	10000	TROUT	MIKECR	5	40.9	1.28	23	23	2	2	1	23	1
WESTMILL	06/11/1996	10000	TROUT	MIKECR	5	40.9	1.28	23	23	3	2	1	23	1
WESTMILL	06/12/1996	10000	TROUT	MIKECR	15	40.9	1.28	10	10	1	9	0	23	2
WESTMILL	06/12/1996	10000	TROUT	MIKECR	15	40.9	1.28	10	7	2	0	1	23	2
WESTMILL	06/12/1996	10000	TROUT	MIKECR	15	40.9	1.28	10	10	3	0	1	23	2
WESTMILL	06/13/1996	10000	TROUT	MIKECR	0	40.9	1.28	14	5	1	9	0	23	3
WESTMILL	06/13/1996	10000	TROUT	MIKECR	0	40.9	1.28	14	8	2	1	1	23	3
WESTMILL	06/13/1996	10000	TROUT	MIKECR	0	40.9	1.28	14	11	3	1	1	23	3
WESTMILL	06/11/1996	11000	COHO	JAMESR	15	16.6	0.94	42	32	1	9	0	48	1
WESTMILL	06/11/1996	11000	COHO	JAMESR	15	16.6	0.94	42	37	2	0	1	48	1
WESTMILL	06/11/1996	11000	COHO	JAMESR	15	16.6	0.94	42	31	3	0	1	48	1
WESTMILL	06/12/1996	11000	COHO	JAMESR	0	16.6	0.94	44	34	1	9	0	48	2
WESTMILL	06/12/1996	11000	COHO	JAMESR	0	16.6	0.94	44	34	2	1	1	48	2
WESTMILL	06/12/1996	11000	COHO	JAMESR	0	16.6	0.94	44	39	3	1	1	48	2
WESTMILL	06/13/1996	11000	COHO	JAMESR	5	16.6	0.94	48	40	1	9	0	48	3
WESTMILL	06/13/1996	11000	COHO	JAMESR	5	16.6	0.94	48	44	2	2	1	48	3
WESTMILL	06/13/1996	11000	COHO	JAMESR	5	16.6	0.94	48	40	3	2	1	48	3
WESTMILL	06/11/1996	11000	TROUT	JAMESR	15	16.6	0.94	28	22	1	9	0	32	1
WESTMILL	06/11/1996	11000	TROUT	JAMESR	15	16.6	0.94	28	26	2	0	1	32	1
WESTMILL	06/11/1996	11000	TROUT	JAMESR	15	16.6	0.94	28	24	3	0	1	32	1
WESTMILL	06/12/1996	11000	TROUT	JAMESR	0	16.6	0.94	34	24	1	9	0	32	2
WESTMILL	06/12/1996	11000	TROUT	JAMESR	0	16.6	0.94	34	29	2	1	1	32	2
WESTMILL	06/12/1996	11000	TROUT	JAMESR	0	16.6	0.94	34	21	3	1	1	32	2
WESTMILL	06/13/1996	11000	TROUT	JAMESR	5	16.6	0.94	21	17	1	9	0	32	3
WESTMILL	06/13/1996	11000	TROUT	JAMESR	5	16.6	0.94	21	19	2	2	1	32	3
WESTMILL	06/13/1996	11000	TROUT	JAMESR	5	16.6	0.94	21	17	3	2	1	32	3
WESTMILL	06/11/1996	12000	COHO	TIMHAY	5	43.7	0.85	144	125	1	9	0	143	1
WESTMILL	06/11/1996	12000	COHO	TIMHAY	5	43.7	0.85	144	103	2	2	1	143	1
WESTMILL	06/11/1996	12000	COHO	TIMHAY	5	43.7	0.85	144	106	3	2	1	143	1
WESTMILL	06/12/1996	12000	COHO	TIMHAY	15	43.7	0.85	147	121	1	9	0	143	2
WESTMILL	06/12/1996	12000	COHO	TIMHAY	15	43.7	0.85	147	134	2	0	1	143	2
WESTMILL	06/12/1996	12000	COHO	TIMHAY	15	43.7	0.85	147	104	3	0	1	143	2
WESTMILL	06/13/1996	12000	COHO	TIMHAY	0	43.7	0.85	117	98	1	9	0	143	3
WESTMILL	06/13/1996	12000	COHO	TIMHAY	0	43.7	0.85	117	105	2	1	1	143	3
WESTMILL	06/13/1996	12000	COHO	TIMHAY	0	43.7	0.85	117	111	3	1	1	143	3
WESTMILL	06/11/1996	12000	TROUT	TIMHAY	5	43.7	0.85	9	8	1	9	0	19	1
WESTMILL	06/11/1996	12000	TROUT	TIMHAY	5	43.7	0.85	9	9	2	2	1	19	1
WESTMILL	06/11/1996	12000	TROUT	TIMHAY	5	43.7	0.85	9	9	3	2	1	19	1

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMA	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
WESTMILL	06/12/1996	12000	TROUT	TIMHAY	15	43.7	0.85	23	18	1	9	0	19	2
WESTMILL	06/12/1996	12000	TROUT	TIMHAY	15	43.7	0.85	23	10	2	0	1	19	2
WESTMILL	06/12/1996	12000	TROUT	TIMHAY	15	43.7	0.85	23	13	3	0	1	19	2
WESTMILL	06/13/1996	12000	TROUT	TIMHAY	0	43.7	0.85	19	14	1	9	0	19	3
WESTMILL	06/13/1996	12000	TROUT	TIMHAY	0	43.7	0.85	19	17	2	1	1	19	3
WESTMILL	06/13/1996	12000	TROUT	TIMHAY	0	43.7	0.85	19	15	3	1	1	19	3
WESTMILL	06/11/1996	13000	COHO	MIKECR	0	29.2	0.82	41	35	1	9	0	65	1
WESTMILL	06/11/1996	13000	COHO	MIKECR	0	29.2	0.82	41	33	2	1	1	65	1
WESTMILL	06/11/1996	13000	COHO	MIKECR	0	29.2	0.82	41	38	3	1	1	65	1
WESTMILL	06/12/1996	13000	COHO	MIKECR	5	29.2	0.82	65	58	1	9	0	65	2
WESTMILL	06/12/1996	13000	COHO	MIKECR	5	29.2	0.82	65	45	2	2	1	65	2
WESTMILL	06/12/1996	13000	COHO	MIKECR	5	29.2	0.82	65	51	3	2	1	65	2
WESTMILL	06/13/1996	13000	COHO	MIKECR	15	29.2	0.82	52	37	1	9	0	65	3
WESTMILL	06/13/1996	13000	COHO	MIKECR	15	29.2	0.82	52	44	2	0	1	65	3
WESTMILL	06/13/1996	13000	COHO	MIKECR	15	29.2	0.82	52	48	3	0	1	65	3
WESTMILL	06/11/1996	13000	TROUT	MIKECR	0	29.2	0.82	19	19	1	9	0	19	1
WESTMILL	06/11/1996	13000	TROUT	MIKECR	0	29.2	0.82	19	19	2	1	1	19	1
WESTMILL	06/11/1996	13000	TROUT	MIKECR	0	29.2	0.82	19	16	3	1	1	19	1
WESTMILL	06/12/1996	13000	TROUT	MIKECR	5	29.2	0.82	14	10	1	9	0	19	2
WESTMILL	06/12/1996	13000	TROUT	MIKECR	5	29.2	0.82	14	12	2	2	1	19	2
WESTMILL	06/12/1996	13000	TROUT	MIKECR	5	29.2	0.82	14	10	3	2	1	19	2
WESTMILL	06/13/1996	13000	TROUT	MIKECR	15	29.2	0.82	6	5	1	9	0	19	3
WESTMILL	06/13/1996	13000	TROUT	MIKECR	15	29.2	0.82	6	4	2	0	1	19	3
WESTMILL	06/13/1996	13000	TROUT	MIKECR	15	29.2	0.82	6	4	3	0	1	19	3
WESTMILL	06/11/1996	14000	COHO	JAMESR	5	23.5	1.10	92	90	1	9	0	127	1
WESTMILL	06/11/1996	14000	COHO	JAMESR	5	23.5	1.10	92	88	2	2	1	127	1
WESTMILL	06/11/1996	14000	COHO	JAMESR	5	23.5	1.10	92	91	3	2	1	127	1
WESTMILL	06/12/1996	14000	COHO	JAMESR	15	23.5	1.10	129	101	1	9	0	127	2
WESTMILL	06/12/1996	14000	COHO	JAMESR	15	23.5	1.10	129	117	2	0	1	127	2
WESTMILL	06/12/1996	14000	COHO	JAMESR	15	23.5	1.10	129	105	3	0	1	127	2
WESTMILL	06/13/1996	14000	COHO	JAMESR	0	23.5	1.10	132	122	1	9	0	127	3
WESTMILL	06/13/1996	14000	COHO	JAMESR	0	23.5	1.10	132	112	2	1	1	127	3
WESTMILL	06/13/1996	14000	COHO	JAMESR	0	23.5	1.10	132	111	3	1	1	127	3
WESTMILL	06/11/1996	14000	TROUT	JAMESR	5	23.5	1.10	27	27	1	9	0	29	1
WESTMILL	06/11/1996	14000	TROUT	JAMESR	5	23.5	1.10	27	27	2	2	1	29	1
WESTMILL	06/11/1996	14000	TROUT	JAMESR	5	23.5	1.10	27	24	3	2	1	29	1
WESTMILL	06/12/1996	14000	TROUT	JAMESR	15	23.5	1.10	29	29	1	9	0	29	2
WESTMILL	06/12/1996	14000	TROUT	JAMESR	15	23.5	1.10	29	29	2	0	1	29	2
WESTMILL	06/12/1996	14000	TROUT	JAMESR	15	23.5	1.10	29	26	3	0	1	29	2
WESTMILL	06/13/1996	14000	TROUT	JAMESR	0	23.5	1.10	33	23	1	9	0	29	3
WESTMILL	06/13/1996	14000	TROUT	JAMESR	0	23.5	1.10	33	23	2	1	1	29	3
WESTMILL	06/13/1996	14000	TROUT	JAMESR	0	23.5	1.10	33	28	3	1	1	29	3
WESTMILL	06/11/1996	15000	COHO	TIMHAY	0	25.1	0.85	41	39	1	9	0	48	1

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
WESTMILL	06/11/1996	15000	COHO	TIMHAY	0	25.1	0.85	41	40	2	1	1	48	1
WESTMILL	06/11/1996	15000	COHO	TIMHAY	0	25.1	0.85	41	39	3	1	1	48	1
WESTMILL	06/12/1996	15000	COHO	TIMHAY	5	25.1	0.85	47	41	1	9	0	48	2
WESTMILL	06/12/1996	15000	COHO	TIMHAY	5	25.1	0.85	47	44	2	2	1	48	2
WESTMILL	06/12/1996	15000	COHO	TIMHAY	5	25.1	0.85	47	41	3	2	1	48	2
WESTMILL	06/13/1996	15000	COHO	TIMHAY	15	25.1	0.85	50	42	1	9	0	48	3
WESTMILL	06/13/1996	15000	COHO	TIMHAY	15	25.1	0.85	50	46	2	0	1	48	3
WESTMILL	06/13/1996	15000	COHO	TIMHAY	15	25.1	0.85	50	39	3	0	1	48	3
WESTMILL	06/11/1996	15000	TROUT	TIMHAY	0	25.1	0.85	33	23	1	9	0	30	1
WESTMILL	06/11/1996	15000	TROUT	TIMHAY	0	25.1	0.85	33	23	2	1	1	30	1
WESTMILL	06/11/1996	15000	TROUT	TIMHAY	0	25.1	0.85	33	28	3	1	1	30	1
WESTMILL	06/12/1996	15000	TROUT	TIMHAY	5	25.1	0.85	32	14	1	9	0	30	2
WESTMILL	06/12/1996	15000	TROUT	TIMHAY	5	25.1	0.85	32	20	2	2	1	30	2
WESTMILL	06/12/1996	15000	TROUT	TIMHAY	5	25.1	0.85	32	26	3	2	1	30	2
WESTMILL	06/13/1996	15000	TROUT	TIMHAY	15	25.1	0.85	30	22	1	9	0	30	3
WESTMILL	06/13/1996	15000	TROUT	TIMHAY	15	25.1	0.85	30	22	2	0	1	30	3
WESTMILL	06/13/1996	15000	TROUT	TIMHAY	15	25.1	0.85	30	26	3	0	1	30	3
WESTMILL	06/11/1996	16000	COHO	MIKECR	5	34.2	0.79	66	61	1	9	0	78	1
WESTMILL	06/11/1996	16000	COHO	MIKECR	5	34.2	0.79	66	51	2	2	1	78	1
WESTMILL	06/11/1996	16000	COHO	MIKECR	5	34.2	0.79	66	56	3	2	1	78	1
WESTMILL	06/12/1996	16000	COHO	MIKECR	15	34.2	0.79	78	74	1	9	0	78	2
WESTMILL	06/12/1996	16000	COHO	MIKECR	15	34.2	0.79	78	70	2	0	1	78	2
WESTMILL	06/12/1996	16000	COHO	MIKECR	15	34.2	0.79	78	61	3	0	1	78	2
WESTMILL	06/13/1996	16000	COHO	MIKECR	0	34.2	0.79	76	58	1	9	0	78	3
WESTMILL	06/13/1996	16000	COHO	MIKECR	0	34.2	0.79	76	60	2	1	1	78	3
WESTMILL	06/13/1996	16000	COHO	MIKECR	0	34.2	0.79	76	68	3	1	1	78	3
WESTMILL	06/11/1996	16000	TROUT	MIKECR	5	34.2	0.79	24	16	1	9	0	24	1
WESTMILL	06/11/1996	16000	TROUT	MIKECR	5	34.2	0.79	24	20	2	2	1	24	1
WESTMILL	06/11/1996	16000	TROUT	MIKECR	5	34.2	0.79	24	16	3	2	1	24	1
WESTMILL	06/12/1996	16000	TROUT	MIKECR	15	34.2	0.79	15	8	1	9	0	24	2
WESTMILL	06/12/1996	16000	TROUT	MIKECR	15	34.2	0.79	15	9	2	0	1	24	2
WESTMILL	06/12/1996	16000	TROUT	MIKECR	15	34.2	0.79	15	12	3	0	1	24	2
WESTMILL	06/13/1996	16000	TROUT	MIKECR	0	34.2	0.79	11	4	1	9	0	24	3
WESTMILL	06/13/1996	16000	TROUT	MIKECR	0	34.2	0.79	11	9	2	1	1	24	3
WESTMILL	06/13/1996	16000	TROUT	MIKECR	0	34.2	0.79	11	7	3	1	1	24	3
WESTMILL	06/11/1996	17000	COHO	JAMESR	15	34.1	1.01	71	57	1	9	0	83	1
WESTMILL	06/11/1996	17000	COHO	JAMESR	15	34.1	1.01	71	43	2	0	1	83	1
WESTMILL	06/11/1996	17000	COHO	JAMESR	15	34.1	1.01	71	64	3	0	1	83	1
WESTMILL	06/12/1996	17000	COHO	JAMESR	0	34.1	1.01	76	68	1	9	0	83	2
WESTMILL	06/12/1996	17000	COHO	JAMESR	0	34.1	1.01	76	70	2	1	1	83	2
WESTMILL	06/12/1996	17000	COHO	JAMESR	0	34.1	1.01	76	73	3	1	1	83	2
WESTMILL	06/13/1996	17000	COHO	JAMESR	5	34.1	1.01	85	71	1	9	0	83	3
WESTMILL	06/13/1996	17000	COHO	JAMESR	5	34.1	1.01	85	78	2	2	1	83	3

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMA	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
WESTMILL	06/13/1996	17000	COHO	JAMESR	5	34.1	1.01	85	69	3	2	1	83	3
WESTMILL	06/11/1996	17000	TROUT	JAMESR	15	34.1	1.01	34	30	1	9	0	36	1
WESTMILL	06/11/1996	17000	TROUT	JAMESR	15	34.1	1.01	34	28	2	0	1	36	1
WESTMILL	06/11/1996	17000	TROUT	JAMESR	15	34.1	1.01	34	32	3	0	1	36	1
WESTMILL	06/12/1996	17000	TROUT	JAMESR	0	34.1	1.01	36	29	1	9	0	36	2
WESTMILL	06/12/1996	17000	TROUT	JAMESR	0	34.1	1.01	36	34	2	1	1	36	2
WESTMILL	06/12/1996	17000	TROUT	JAMESR	0	34.1	1.01	36	35	3	1	1	36	2
WESTMILL	06/13/1996	17000	TROUT	JAMESR	5	34.1	1.01	33	33	1	9	0	36	3
WESTMILL	06/13/1996	17000	TROUT	JAMESR	5	34.1	1.01	33	33	2	2	1	36	3
WESTMILL	06/13/1996	17000	TROUT	JAMESR	5	34.1	1.01	33	29	3	2	1	36	3
WESTMILL	06/11/1996	18000	COHO	TIMHAY	0	27.4	1.04	108	80	1	9	0	96	1
WESTMILL	06/11/1996	18000	COHO	TIMHAY	0	27.4	1.04	108	77	2	1	1	96	1
WESTMILL	06/11/1996	18000	COHO	TIMHAY	0	27.4	1.04	108	94	3	1	1	96	1
WESTMILL	06/12/1996	18000	COHO	TIMHAY	5	27.4	1.04	91	86	1	9	0	96	2
WESTMILL	06/12/1996	18000	COHO	TIMHAY	5	27.4	1.04	91	90	2	2	1	96	2
WESTMILL	06/12/1996	18000	COHO	TIMHAY	5	27.4	1.04	91	89	3	2	1	96	2
WESTMILL	06/13/1996	18000	COHO	TIMHAY	15	27.4	1.04	102	79	1	9	0	96	3
WESTMILL	06/13/1996	18000	COHO	TIMHAY	15	27.4	1.04	102	92	2	0	1	96	3
WESTMILL	06/13/1996	18000	COHO	TIMHAY	15	27.4	1.04	102	82	3	0	1	96	3
WESTMILL	06/11/1996	18000	TROUT	TIMHAY	0	27.4	1.04	38	23	1	9	0	38	1
WESTMILL	06/11/1996	18000	TROUT	TIMHAY	0	27.4	1.04	38	36	2	1	1	38	1
WESTMILL	06/11/1996	18000	TROUT	TIMHAY	0	27.4	1.04	38	34	3	1	1	38	1
WESTMILL	06/12/1996	18000	TROUT	TIMHAY	5	27.4	1.04	31	28	1	9	0	38	2
WESTMILL	06/12/1996	18000	TROUT	TIMHAY	5	27.4	1.04	31	29	2	2	1	38	2
WESTMILL	06/12/1996	18000	TROUT	TIMHAY	5	27.4	1.04	31	30	3	2	1	38	2
WESTMILL	06/13/1996	18000	TROUT	TIMHAY	15	27.4	1.04	27	27	1	9	0	38	3
WESTMILL	06/13/1996	18000	TROUT	TIMHAY	15	27.4	1.04	27	27	2	0	1	38	3
WESTMILL	06/13/1996	18000	TROUT	TIMHAY	15	27.4	1.04	27	27	3	0	1	38	3
WESTMILL	06/11/1996	20000	COHO	JAMESR	0	27.2	1.31	69	39	1	9	0	72	1
WESTMILL	06/11/1996	20000	COHO	JAMESR	0	27.2	1.31	69	63	2	1	1	72	1
WESTMILL	06/11/1996	20000	COHO	JAMESR	0	27.2	1.31	69	57	3	1	1	72	1
WESTMILL	06/12/1996	20000	COHO	JAMESR	5	27.2	1.31	68	64	1	9	0	72	2
WESTMILL	06/12/1996	20000	COHO	JAMESR	5	27.2	1.31	68	57	2	2	1	72	2
WESTMILL	06/12/1996	20000	COHO	JAMESR	5	27.2	1.31	68	60	3	2	1	72	2
WESTMILL	06/13/1996	20000	COHO	JAMESR	15	27.2	1.31	76	57	1	9	0	72	3
WESTMILL	06/13/1996	20000	COHO	JAMESR	15	27.2	1.31	76	60	2	0	1	72	3
WESTMILL	06/13/1996	20000	COHO	JAMESR	15	27.2	1.31	76	68	3	0	1	72	3
WESTMILL	06/11/1996	20000	TROUT	JAMESR	0	27.2	1.31	18	16	1	9	0	20	1
WESTMILL	06/11/1996	20000	TROUT	JAMESR	0	27.2	1.31	18	18	2	1	1	20	1
WESTMILL	06/11/1996	20000	TROUT	JAMESR	0	27.2	1.31	18	18	3	1	1	20	1
WESTMILL	06/12/1996	20000	TROUT	JAMESR	5	27.2	1.31	15	14	1	9	0	20	2
WESTMILL	06/12/1996	20000	TROUT	JAMESR	5	27.2	1.31	15	13	2	2	1	20	2
WESTMILL	06/12/1996	20000	TROUT	JAMESR	5	27.2	1.31	15	13	3	2	1	20	2

CREEK	DATE	UNIT	SPP	DIVER	INT	LNTH	MMAX	MBC	COUNT	nDIVE	pdi	first	MBC.total	INTORDER
WESTMILL	06/13/1996	20000	TROUT	JAMESR	15	27.2	1.31	20	15	1	9	0	20	3
WESTMILL	06/13/1996	20000	TROUT	JAMESR	15	27.2	1.31	20	18	2	0	1	20	3
WESTMILL	06/13/1996	20000	TROUT	JAMESR	15	27.2	1.31	20	19	3	0	1	20	3
WESTMILL	06/11/1996	23000	COHO	JAMESR	15	39.2	1.52	76	69	1	9	0	86	1
WESTMILL	06/11/1996	23000	COHO	JAMESR	15	39.2	1.52	76	62	2	0	1	86	1
WESTMILL	06/11/1996	23000	COHO	JAMESR	15	39.2	1.52	76	62	3	0	1	86	1
WESTMILL	06/12/1996	23000	COHO	JAMESR	0	39.2	1.52	86	74	1	9	0	86	2
WESTMILL	06/12/1996	23000	COHO	JAMESR	0	39.2	1.52	86	74	2	1	1	86	2
WESTMILL	06/12/1996	23000	COHO	JAMESR	0	39.2	1.52	86	80	3	1	1	86	2
WESTMILL	06/13/1996	23000	COHO	JAMESR	5	39.2	1.52	80	74	1	9	0	886	3
WESTMILL	06/13/1996	23000	COHO	JAMESR	5	39.2	1.52	80	68	2	2	1	86	3
WESTMILL	06/13/1996	23000	COHO	JAMESR	5	39.2	1.52	80	67	3	2	1	86	3
WESTMILL	06/11/1996	23000	TROUT	JAMESR	15	39.2	1.52	19	12	1	9	0	22	1
WESTMILL	06/11/1996	23000	TROUT	JAMESR	15	39.2	1.52	19	17	2	0	1	22	1
WESTMILL	06/11/1996	23000	TROUT	JAMESR	15	39.2	1.52	19	15	3	0	1	22	1
WESTMILL	06/12/1996	23000	TROUT	JAMESR	0	39.2	1.52	23	15	1	9	0	22	2
WESTMILL	06/12/1996	23000	TROUT	JAMESR	0	39.2	1.52	23	19	2	1	1	22	2
WESTMILL	06/12/1996	23000	TROUT	JAMESR	0	39.2	1.52	23	14	3	1	1	22	2
WESTMILL	06/13/1996	23000	TROUT	JAMESR	5	39.2	1.52	22	22	1	9	0	22	3
WESTMILL	06/13/1996	23000	TROUT	JAMESR	5	39.2	1.52	22	18	2	2	1	22	3
WESTMILL	06/13/1996	23000	TROUT	JAMESR	5	39.2	1.52	22	22	3	2	1	22	3

APPENDIX B. EXAMPLE QUALITY CONTROL SHEET

Freq#	Unit#	Mark?	Freq#	Unit#	Mark?	Freq#	Unit#	Mark?	Freq#	Unit#	Mark?
1			41			81			121		
2			42			82			122		
3			43			83			123		
4			44			84			124		
5			45			85			125		
6			46			86			126		
7			47			87			127		
8			48			88			128		
9			49			89			129		
10			50			90			130		
11			51			91			131		
12			52			92			132		
13			53			93			133		
14			54			94			134		
15			55			95			135		
16			56			96			136		
17			57			97			137		
18			58			98			138		
19			59			99			139		
20			60			100			140		
21			61			101			141		
22			62			102			142		
23			63			103			143		
24			64			104			144		
25			65			105			145		
26			66			106			146		
27			67			107			147		
28			68			108			148		
29			69			109			149		
30			70			110			150		
31			71			111			151		
32			72			112			152		
33			73			113			153		
34			74			114			154		
35			75			115			155		
36			76			116			156		
37			77			117			157		
38			78			118			158		
39			79			119			159		
40			80			120			160		

**APPENDIX C. WEST BRANCH MILL CREEK 1996 POPULATION
ABUNDANCE DATA**

Table 21. Habitat data collected for the West Branch of Mill Creek during the 1996 summer survey. The variables gathered are defined as follows: HAB# is the habitat unit number, HDATE is the date on which the habitat-typing took place, CHCODE is the channel code, %FLOW is the estimated percent flow that the channel contained, LEN is the measured length of each habitat unit, MMAX is the measured maximum depth, D/S? is whether or not the unit was selected for phase I sampling, and WIDTH is the average of the two measured widths for each habitat unit.

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001001	6/14/96	RIFFLE	0	100	79.9	0.24	NO	8.8
001002	6/14/96	POOL	0	100	121.3		NO	9.4
001003	6/14/96	RIFFLE	0	100	19.5	0.43	NO	7.8
001004	6/14/96	POOL	0	100	12.2	0.98	NO	8.0
001005	6/14/96	RIFFLE	0	100	54.9	0.94	NO	6.6
001006	6/14/96	POOL	0	100	21.3	0.91	NO	6.7
001007	6/14/96	RIFFLE	0	100	16.5	0.27	NO	8.6
001008	6/14/96	RUN	0	100	29.3	0.49	NO	7.4
001009	6/14/96	DEEP POOL	0	100	18.6	1.07	DIVE	6.9
001010	6/14/96	POOL	0	100	29.0	0.58	NO	9.8
001011	6/14/96	POOL	0	100	60.4	0.64	NO	8.7
001012	6/14/96	POOL	0	100	32.0	0.55	DIVE	6.1
001013	6/14/96	RIFFLE	0	100	7.9	0.61	NO	5.0
001014	6/14/96	POOL	0	100	23.2	0.94	DIVE	5.9
001015	6/14/96	POOL	0	100	20.4	0.61	NO	8.1
001016	6/14/96	POOL	0	100	21.0		DIVE	8.4
001017	6/14/96	DEEP POOL	0	100	56.7	1.10	NO	7.8
001018	6/14/96	RUN	0	100	28.7	0.52	NO	6.1
001019	6/14/96	DEEP POOL	0	100	64.0	1.01	NO	6.1
001020	6/14/96	POOL	0	100	54.6	0.70	DIVE	6.4
001021	6/14/96	RIFFLE	0	100	14.0	0.27	NO	6.6
001022	6/14/96	POOL	0	100	26.5	0.70	NO	7.9
001023	6/14/96	POOL	0	100	49.1	1.22	NO	6.7
001024	6/14/96	POOL	1	75	31.4	1.10	DIVE	6.1
001025	6/14/96	RIFFLE	1	65	15.5	0.46	NO	7.5
001026	6/14/96	DEEP POOL	1	80	32.3	0.94	DIVE	13.1
001027	6/14/96	SIDE CHANNEL	2	20	26.8	0.55	NO	3.8
001028	6/14/96	SIDE CHANNEL	3	10	36.6	0.06	NO	3.4
001029	6/14/96	SIDE CHANNEL	4	5	20.4	0.46	NO	3.4
001030	6/14/96	DEEP POOL	0	100	57.9		NO	7.2
001031	6/14/96	RIFFLE	0	100	61.0	0.55	NO	8.5
001032	6/14/96	RUN	1	90	20.1	0.58	NO	5.9
001033	6/14/96	SIDE CHANNEL	2	10	18.9	0.24	NO	5.5
001034	6/26/96	DEEP POOL	0	100	52.7	1.37	NO	7.0
001035	6/26/96	RIFFLE	0	100	14.0	0.46	NO	4.9

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001036	6/26/96	DEEP POOL	0	100	47.9	1.28	NO	5.8
001037	6/26/96	RIFFLE	0	100	21.3	0.18	SHOCK	5.5
001038	6/26/96	POOL	0	100	15.2	0.85	NO	7.8
001039	6/26/96	POOL	0	100	56.1	1.31	NO	9.0
001040	6/26/96	RIFFLE	1	60	24.7	0.18	NO	3.9
001041	6/26/96	POOL	1	60	21.3	0.76	DIVE	3.0
001042	6/26/96	RIFFLE	1	60	28.0	0.37	NO	3.0
001043	6/26/96	SIDE CHANNEL	2	40	89.9	0.49	NO	5.2
001044	6/26/96	DEEP POOL	0	100	63.4	0.91	NO	7.5
001045	6/26/96	RIFFLE	0	100	9.4	0.24	NO	3.7
001046	6/26/96	POOL	0	100	27.1	0.94	NO	6.1
001047	6/26/96	RUN	0	100	46.6	0.37	NO	8.7
001048	6/26/96	POOL	0	100	22.9	0.94	NO	6.4
001049	6/26/96	RIFFLE	0	100	40.5	0.15	NO	5.6
001050	6/26/96	DEEP POOL	0	100	72.2	1.49	DIVE	6.2
001051	6/26/96	RIFFLE	0	100	16.8	0.18	SHOCK	6.9
001052	6/26/96	POOL	0	100	25.6	0.82	NO	6.4
001053	6/26/96	RUN	0	100	20.4	0.40	NO	4.9
001054	6/26/96	RIFFLE	0	100	32.9	0.18	NO	6.7
001055	6/26/96	POOL	0	100	32.9	0.82	DIVE	6.9
001056	6/26/96	DEEP POOL	0	100	40.8	1.40	DIVE	5.3
001057	6/26/96	RIFFLE	0	100	6.7	0.18	NO	4.7
001058	6/26/96	DEEP POOL	0	100	81.1	2.01	NO	4.0
001059	6/26/96	RIFFLE	0	100	8.2	0.15	NO	5.6
001060	6/26/96	RUN	0	100	43.0	0.52	NO	6.7
001061	6/26/96	POOL	0	100	22.3	1.13	NO	5.5
001062	6/26/96	POOL	0	100	13.7	0.61	DIVE	4.7
001063	6/26/96	RIFFLE	0	100	15.2	0.27	NO	4.3
001064	6/26/96	POOL	0	100	25.3	0.91	NO	4.0
001065	6/26/96	POOL	0	100	46.6	0.91	NO	3.0
001066	6/26/96	RIFFLE	0	100	18.9	0.82	NO	3.2
001067	6/26/96	DEEP POOL	0	100	23.8		DIVE	4.7
001068	6/26/96	RIFFLE	0	100	12.8	0.21	NO	6.6
001069	6/26/96	RUN	0	100	44.8	0.64	NO	5.9
001070	6/26/96	RIFFLE	0	100	23.8	0.46	NO	6.7
001071	6/26/96	RUN	0	100	27.7	0.52	DIVE	9.3
001072	6/26/96	RIFFLE	0	100	28.3	0.61	NO	9.9
001073	6/26/96	DEEP POOL	0	100	42.7		DIVE	7.6
001074	6/26/96	RIFFLE	0	100	45.1	0.34	NO	5.9
001075	6/26/96	POOL	0	100	39.9	0.98	NO	7.9
001076	6/26/96	DEEP POOL	0	100	39.0	1.55	NO	9.3
001077	6/26/96	RIFFLE	0	100	28.3	0.27	NO	9.3
001078	6/26/96	POOL	0	100	30.8	0.88	DIVE	7.0

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001079	6/26/96	RUN	0	100	11.6	0.46	NO	5.0
001080	6/26/96	POOL	0	100	13.4	0.58	DIVE	7.2
001081	6/26/96	DEEP POOL	0	100	29.6	1.22	NO	6.7
001082	6/26/96	RIFFLE	0	100	11.3	0.18	NO	5.2
001083	6/26/96	DEEP POOL	0	100	29.3	1.52	NO	7.0
001084	6/26/96	SIDE CHANNEL	1	5	26.8	0.30	NO	4.0
001085	6/26/96	DEEP POOL	0	100	41.8	1.07	DIVE	7.7
001086	6/26/96	RIFFLE	0	100	11.6	0.21	NO	8.6
001087	6/26/96	RUN	0	100	35.4	0.58	DIVE	5.8
001088	6/26/96	POOL	0	100	14.9	0.64	DIVE	5.8
001089	6/26/96	RUN	1	95	11.9	0.55	DIVE	4.0
001090	6/26/96	SIDE CHANNEL	2	5	35.7	0.40	NO	1.7
001091	6/26/96	POOL	0	100	19.2	1.07	NO	4.9
001092	6/26/96	RIFFLE	0	100	21.6	0.49	SHOCK	6.6
001093	6/26/96	POOL	0	100	22.3	0.82	DIVE	5.3
001094	6/26/96	RIFFLE	0	100	6.7	0.21	NO	4.6
001095	6/26/96	POOL	0	100	99.1	0.67	NO	7.0
001096	6/26/96	POOL	0	100	32.0	0.91	NO	6.2
001097	6/26/96	RIFFLE	0	100	10.7	0.18	NO	5.3
001098	6/26/96	RUN	0	100	40.2	0.55	NO	6.1
001099	6/26/96	RIFFLE	0	100	19.2	0.27	NO	6.7
001100	6/26/96	POOL	0	100	37.2	1.01	NO	7.8
001101	6/26/96	RIFFLE	0	100	114.3	0.67	NO	9.1
001102	6/26/96	POOL	0	100	39.3	0.91	NO	9.0
001103	6/26/96	RIFFLE	0	100	12.8	0.55	NO	7.0
001104	6/26/96	POOL	0	100	31.4	0.67	NO	7.8
001105	6/26/96	RIFFLE	1	70	18.0	0.37	NO	5.5
001106	6/26/96	SIDE CHANNEL	2	30	20.1	0.40	NO	3.7
001107	6/26/96	DEEP POOL	0	100	20.1	0.67	DIVE	7.6
001108	6/26/96	POOL	0	100	26.2	0.98	NO	9.0
001109	6/26/96	POOL	0	100	27.1	0.88	DIVE	10.2
001110	6/26/96	POOL	0	100	28.0	0.85	NO	7.2
001111	6/26/96	RIFFLE	0	100	29.3	0.18	NO	5.2
001112	6/26/96	POOL	0	100	45.1	1.04	NO	6.4
001113	6/26/96	RIFFLE	0	100	41.5	0.18	NO	9.1
001114	6/26/96	RUN	0	100	66.8	0.30	NO	8.2
001115	6/26/96	RIFFLE	0	100	23.5	0.24	NO	7.3
001116	6/26/96	RUN	0	100	27.4	0.40	NO	5.9
001117	6/26/96	RIFFLE	1	50	32.0	0.18	NO	3.0
001118	6/26/96	RUN	1	50	11.3	0.46	NO	2.7
001119	6/26/96	RIFFLE	1	50	18.6	0.21	NO	3.0
001120	6/26/96	RIFFLE	2	50	11.6	0.40	NO	3.0
001121	6/26/96	POOL	2	50	19.5	0.91	DIVE	3.2

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001122	6/26/96	RIFFLE	2	50	27.7	0.30	SHOCK	4.1
001123	6/26/96	POOL	2	50	29.0	0.49	NO	3.5
001124	6/26/96	RIFFLE	2	50	5.5	0.15	NO	2.1
001125	6/26/96	DEEP POOL	0	100	46.0	1.16	NO	5.5
001126	6/26/96	RUN	0	100	25.3	0.40	NO	4.6
001127	6/26/96	RIFFLE	0	100	54.3	0.37	NO	3.7
001128	6/26/96	DEEP POOL	0	100	46.6	1.13	NO	2.7
001129	6/26/96	DEEP POOL	0	100	63.4	0.91	DIVE	2.9
001130	6/26/96	RIFFLE	0	100	33.8	0.27	NO	5.0
001131	6/26/96	POOL	0	100	19.5	0.79	NO	5.6
001132	6/26/96	RIFFLE	0	100	32.6	0.67	NO	4.6
001133	6/26/96	POOL	0	100	28.7	1.07	NO	5.8
001134	6/26/96	RIFFLE	0	100	16.5	0.58	NO	9.1
001135	6/26/96	POOL	0	100	34.7	0.94	DIVE	10.1
001136	6/26/96	RIFFLE	0	100	26.2	0.30	NO	7.3
001137	6/26/96	DEEP POOL	0	100	20.7		NO	4.7
001138	6/26/96	RIFFLE	0	100	93.0	0.43	NO	5.9
001139	6/26/96	POOL	0	100	51.8	0.82	NO	5.9
001140	6/26/96	POOL	0	100	15.2	1.01	DIVE	4.1
001141	6/26/96	RIFFLE	0	100	32.9	0.24	SHOCK	5.8
001142	6/26/96	DEEP POOL	0	100	29.6	1.28	NO	5.3
001143	6/26/96	RIFFLE	0	100	46.0	0.24	NO	5.9
001144	6/26/96	POOL	0	100	25.9	0.98	NO	6.1
001145	6/26/96	RIFFLE	0	100	28.0	0.27	NO	4.4
001146	6/26/96	POOL	0	100	14.3	0.58	NO	3.8
001147	6/26/96	RIFFLE	1	95	18.9	0.46	NO	2.4
001148	6/26/96	RUN	1	95	19.2	0.61	NO	3.4
001149	6/26/96	SIDE CHANNEL	2	5	36.0	0.55	NO	2.3
001150	6/26/96	POOL	0	100	18.6	0.98	DIVE	5.6
001151	6/26/96	RIFFLE	0	100	27.4	0.21	NO	6.2
001152	6/26/96	POOL	0	100	43.0	0.98	NO	7.5
001153	6/26/96	RIFFLE	0	100	51.2	0.24	NO	7.3
001154	6/26/96	POOL	0	100	27.1	0.82	NO	5.0
001155	6/26/96	RIFFLE	0	100	11.9	0.15	SHOCK	4.3
001156	6/26/96	POOL	0	100	22.9	0.58	NO	4.4
001157	6/26/96	POOL	0	100	24.7	1.04	NO	5.9
001158	6/26/96	RIFFLE	1	50	29.9	0.49	NO	5.5
001159	6/26/96	POOL	1	50	14.9	0.79	NO	3.8
001160	6/26/96	RIFFLE	1	50	15.8	0.40	NO	2.4
001161	6/26/96	DEEP POOL	1	50	10.1	0.98	NO	2.3
001162	6/26/96	RIFFLE	1	50	9.4	0.18	NO	2.9
001163	6/26/96	RIFFLE	2	50	58.8	0.55	NO	3.4
001164	6/26/96	RUN	0	100	32.9	0.67	DIVE	5.6

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001165	6/26/96	RIFFLE	0	100	17.4	0.21	NO	4.3
001166	6/26/96	POOL	0	100	25.3	0.58	NO	4.9
001167	6/26/96	POOL	0	100	43.3	0.70	DIVE	4.0
001168	6/26/96	RIFFLE	0	100	46.0	0.43	NO	4.3
001169	6/26/96	RUN	0	100	20.1	0.52	DIVE	4.1
001170	6/26/96	POOL	0	100	17.1	1.04	NO	6.4
001171	6/26/96	RUN	0	100	52.7	0.34	DIVE	6.9
001172	6/26/96	RIFFLE	0	100	10.1	0.21	SHOCK	4.0
001173	6/26/96	POOL	0	100	38.1	0.79	NO	3.2
001174	6/26/96	RIFFLE	0	100	18.3	0.18	NO	5.9
001175	6/27/96	POOL	0	100	22.0	0.52	NO	6.2
001176	6/27/96	RIFFLE	0	100	25.5	0.18	NO	5.6
001177	6/27/96	POOL	0	100	16.2	0.61	NO	6.2
001178	6/27/96	DEEP POOL	0	100	41.1	1.04	NO	4.9
001179	6/27/96	RIFFLE	0	100	24.5	0.18	NO	7.9
001180	6/27/96	POOL	1	40	30.3		DIVE	5.3
001181	6/27/96	RIFFLE	1	20	5.5	0.15	NO	2.4
001182	6/27/96	RIFFLE	2	20	14.2	0.15	NO	1.7
001183	6/27/96	POOL	0	100	33.5	0.79	NO	5.6
001184	6/27/96	RIFFLE	0	100	33.3	0.24	NO	5.6
001185	6/27/96	DEEP POOL	0	100	31.2	1.04	NO	7.9
001186	6/27/96	RIFFLE	1	90	47.3	0.27	NO	5.3
001187	6/27/96	SIDE CHANNEL	2	10	39.1	0.18	NO	2.6
001188	6/27/96	DEEP POOL	0	100	51.9	1.19	DIVE	8.5
001189	6/27/96	RUN	0	100	36.5	0.55	NO	6.9
001190	6/27/96	DEEP POOL	0	100	59.4	0.76	NO	4.1
001191	6/27/96	RIFFLE	0	100	90.3	0.55	NO	4.0
001192	6/27/96	POOL	0	100	25.9		DIVE	4.7
001193	6/27/96	RUN	0	100	32.8	0.46	NO	3.8
001194	6/27/96	RIFFLE	0	100	21.9	0.30	NO	3.4
001195	6/27/96	POOL	0	100	22.3		NO	3.8
001196	6/27/96	RIFFLE	0	100	15.9	0.30	NO	5.0
001197	6/27/96	POOL	0	100	19.9	1.04	DIVE	5.3
001198	6/27/96	DEEP POOL	0	100	32.7	0.76	NO	4.0
001199	6/27/96	RUN	0	100	31.0	0.40	DIVE	3.4
001200	6/27/96	RIFFLE	0	100	70.8		NO	8.5
001201	6/27/96	POOL	0	100	60.6	0.73	NO	7.0
001202	6/27/96	POOL	0	100	75.2	0.94	DIVE	4.1
001203	6/27/96	RIFFLE	0	100	25.0	0.18	NO	5.5
001204	6/27/96	POOL	0	100	48.0	1.58	NO	5.9
001205	6/27/96	POOL	0	100	25.2	0.76	NO	3.8
001206	6/27/96	POOL	0	100	42.7	0.88	DIVE	3.8
001207	6/27/96	RIFFLE	0	100	13.0	0.30	SHOCK	5.0

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001208	6/27/96	DEEP POOL	0	100	24.7	1.31	NO	6.2
001209	6/27/96	RIFFLE	0	100	32.9	0.37	NO	5.0
001210	6/27/96	POOL	0	100	35.5	0.94	NO	3.4
001211	6/27/96	RIFFLE	0	100	6.3	0.12	NO	3.0
001212	6/27/96	POOL	0	100	13.1	0.82	DIVE	4.3
001213	6/27/96	RIFFLE	0	100	24.0	1.22	NO	4.1
001214	6/27/96	RUN	0	100	18.8	0.64	NO	3.5
001215	6/27/96	DEEP POOL	0	100	29.8	1.22	DIVE	3.0
001216	6/27/96	POOL	0	100	23.9	0.73	NO	2.1
001217	6/27/96	RIFFLE	0	100	17.3	0.06	NO	3.8
001218	6/27/96	POOL	0	100	44.2	1.13	DIVE	4.4
001219	6/27/96	RUN	0	100	14.1	0.46	DIVE	3.4
001220	6/27/96	DEEP POOL	0	100	14.6	0.70	NO	2.6
001221	6/27/96	POOL	0	100	24.7	0.98	NO	4.6
001222	6/27/96	RIFFLE	0	100	9.0	0.15	NO	6.6
001223	6/27/96	DEEP POOL	0	100	35.0	0.76	DIVE	5.3
001224	6/27/96	POOL	0	100	16.7	0.94	DIVE	4.6
001225	6/27/96	RIFFLE	0	100	51.1	0.34	SHOCK	3.5
001226	6/27/96	POOL	0	100	10.8	0.64	NO	3.5
001227	6/27/96	RUN	0	100	31.1	0.34	DIVE	3.8
001228	6/27/96	RIFFLE	0	100	35.3	0.15	NO	4.7
001229	6/27/96	POOL	0	100	19.7	1.22	NO	4.3
001230	6/27/96	RIFFLE	0	100	18.0	0.06	NO	2.9
001231	6/27/96	DEEP POOL	0	100	23.3	1.31	DIVE	3.0
001232	6/27/96	POOL	0	100	49.6	0.76	NO	3.5
001233	6/27/96	RIFFLE	0	100	59.9	0.40	NO	3.2
001234	6/27/96	POOL	0	100	23.1	1.04	NO	4.0
001235	6/27/96	POOL	0	100	38.8	1.22	NO	3.8
001236	6/27/96	RIFFLE	0	100	11.2	0.03	NO	2.4
001237	6/27/96	POOL	0	100	19.2	1.58	DIVE	2.9
001238	6/27/96	POOL	0	100	33.5	1.10	NO	2.9
001239	6/27/96	RIFFLE	0	100	28.4	0.24	NO	3.0
001240	6/27/96	POOL	0	100	26.4	0.91	NO	4.0
001241	6/27/96	RIFFLE	0	100	18.5	0.09	NO	4.0
001242	6/27/96	RUN	0	100	36.9	0.58	NO	2.7
001243	6/27/96	RIFFLE	0	100	27.7	0.55	NO	3.0
001244	6/27/96	POOL	0	100	21.4	1.16	DIVE	4.7
001245	6/27/96	RIFFLE	0	100	40.9	0.15	NO	7.8
001246	6/27/96	POOL	0	100	30.9	0.64	DIVE	9.0
001247	6/27/96	RIFFLE	0	100	29.3	0.12	NO	
001248	6/27/96	POOL	0	100	39.9	1.22	NO	
001249	6/27/96	RUN	0	100	17.5	0.58	NO	2.1
001250	6/27/96	RIFFLE	0	100	20.5	0.18	NO	4.4

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001251	6/27/96	POOL	0	100	40.1	0.91	DIVE	7.2
001252	6/27/96	RIFFLE	0	100	17.9	0.30	NO	7.5
001253	6/27/96	POOL	0	100	17.9	1.13	NO	7.3
001254	6/27/96	DEEP POOL	0	100	23.7	1.55	NO	8.5
001255	6/27/96	RIFFLE	0	100	20.3	0.37	NO	8.8
001256	6/27/96	DEEP POOL	0	100	36.1	1.95	NO	6.7
001257	6/27/96	RIFFLE	0	100	20.4	0.24	NO	5.2
001258	6/27/96	DEEP POOL	0	100	26.7	0.76	NO	3.7
001259	6/27/96	DEEP POOL	0	100	52.6	0.73	NO	2.3
001260	6/27/96	RIFFLE	0	100	22.9	0.46	NO	2.1
001261	6/27/96	POOL	0	100	16.5	1.04	NO	1.8
001262	6/27/96	RIFFLE	0	100	46.6		NO	4.4
001263	6/27/96	POOL	0	100	14.7	1.16	NO	5.3
001264	6/27/96	RIFFLE	0	100	15.8	0.18	NO	4.3
001265	6/27/96	POOL	0	100	32.0	0.82	NO	4.9
001266	6/27/96	POOL	0	100	46.0	0.61	DIVE	4.7
001267	6/27/96	RIFFLE	0	100	18.8	0.34	NO	6.6
001268	6/27/96	RUN	0	100	16.5	0.40	DIVE	6.6
001269	6/27/96	RIFFLE	0	100	17.7	0.15	NO	6.1
001270	6/27/96	POOL	0	100	27.6	0.55	DIVE	5.8
001271	6/27/96	POOL	0	100	32.3	0.82	NO	4.4
001272	6/27/96	RIFFLE	0	100	76.8	0.30	NO	5.0
001273	6/27/96	RUN	0	100	31.2	0.67	DIVE	5.6
001274	6/27/96	POOL	0	100	34.6	1.40	NO	4.9
001275	6/27/96	POOL	0	100	31.8	0.49	NO	4.1
001276	6/27/96	RIFFLE	0	100	36.0	0.18	NO	4.7
001277	6/27/96	POOL	0	100	19.3	0.67	NO	4.3
001278	6/27/96	RIFFLE	0	100	14.8	0.49	NO	4.3
001279	6/27/96	POOL	0	100	13.9	1.01	NO	4.7
001280	6/27/96	RIFFLE	0	100	7.9	0.15	NO	6.1
001281	6/27/96	POOL	0	100	27.6	0.64	NO	6.6
001282	6/27/96	RUN	0	100	37.9	0.61	NO	7.2
001283	6/27/96	POOL	0	100	38.2	0.73	DIVE	6.7
001284	6/27/96	RIFFLE	0	100	9.1	0.15	NO	4.0
001285	6/27/96	RUN	0	100	8.9	0.30	NO	3.7
001286	6/27/96	RIFFLE	0	100	10.5	0.24	SHOCK	3.8
001287	6/27/96	RUN	0	100	23.4	0.46	NO	4.0
001288	6/27/96	RUN	0	100	20.7	0.30	DIVE	3.2
001289	6/27/96	RIFFLE	0	100	9.0	0.12	SHOCK	2.6
001290	6/27/96	DEEP POOL	0	100	13.8	0.91	NO	2.9
001291	6/27/96	RUN	0	100	5.6	0.37	DIVE	2.7
001292	6/27/96	DEEP POOL	0	100	18.1	1.22	DIVE	2.0
001293	6/27/96	POOL	0	100	22.8	0.70	DIVE	2.6

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001294	6/27/96	RIFFLE	0	100	14.4	0.30	NO	2.9
001295	6/27/96	DEEP POOL	0	100	36.3		NO	2.6
001296	6/27/96	RIFFLE	0	100	15.9	0.43	NO	3.0
001297	6/27/96	RUN	0	100	10.8	0.40	DIVE	2.6
001298	6/27/96	RIFFLE	0	100	8.8	0.15	NO	2.1
001299	6/27/96	DEEP POOL	0	100	26.1	1.95	DIVE	3.8
001300	6/27/96	RIFFLE	0	100	18.3	0.37	NO	5.9
001301	6/27/96	RUN	0	100	23.7	0.43	NO	6.6
001302	6/27/96	RIFFLE	0	100	32.9	0.37	NO	5.6
001303	6/27/96	RUN	0	100	16.7	0.37	NO	4.6
001304	6/27/96	RIFFLE	0	100	9.8	0.15	NO	4.4
001305	6/27/96	DEEP POOL	0	100	18.4	0.91	NO	3.2
001306	6/27/96	RIFFLE	0	100	26.0	0.24	NO	2.6
001307	6/27/96	POOL	0	100	7.0	0.49	DIVE	2.9
001308	6/27/96	RIFFLE	0	100	6.3	0.15	NO	2.9
001309	6/27/96	POOL	0	100	12.2	1.07	DIVE	2.6
001310	6/27/96	RIFFLE	0	100	21.3	0.15	NO	2.4
001311	6/27/96	RUN	0	100	13.9	0.37	DIVE	3.7
001312	6/27/96	RIFFLE	0	100	24.0	0.34	NO	
001313	6/27/96	RUN	0	100	17.5	0.40	NO	
001314	6/27/96	RIFFLE	0	100	32.9	0.76	NO	5.5
001315	6/27/96	POOL	0	100	25.6	0.67	NO	5.9
001316	6/27/96	RIFFLE	0	100	17.3	0.21	NO	5.5
001317	6/27/96	POOL	0	100	27.7	0.85	NO	4.6
001318	6/27/96	RIFFLE	0	100	14.5	0.37	NO	4.3
001319	6/27/96	POOL	0	100	17.0	1.37	NO	5.2
001320	6/27/96	POOL	0	100	19.7	0.88	DIVE	4.3
001321	6/27/96	RIFFLE	0	100	17.1	0.27	NO	3.4
001322	6/27/96	POOL	0	100	18.5	0.58	NO	3.4
001323	6/27/96	RIFFLE	0	100	34.3	0.30	NO	3.8
001324	6/27/96	POOL	0	100	19.2	0.64	NO	3.7
001325	6/27/96	RIFFLE	0	100	15.9	0.18	NO	3.5
001326	6/27/96	POOL	0	100	17.3	1.34	DIVE	5.2
001327	6/27/96	RIFFLE	0	100	22.5	0.34	NO	5.3
001328	6/27/96	POOL	0	100	14.3	1.01	NO	3.2
001329	6/27/96	POOL	0	100	15.0	0.52	DIVE	3.0
001330	6/27/96	RIFFLE	0	100	11.9	0.27	NO	4.4
001331	6/27/96	POOL	0	100	27.2	0.61	NO	3.8
001332	6/27/96	POOL	0	100	19.3	0.76	NO	3.5
001333	6/27/96	POOL	0	100	32.0	0.67	DIVE	5.3
001334	6/27/96	POOL	0	100	9.0	0.79	NO	5.2
001335	6/27/96	RIFFLE	0	100	78.7	0.40	NO	4.6
001336	6/27/96	POOL	0	100	15.5	0.67	NO	4.3

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001337	6/27/96	DEEP POOL	0	100	23.5		NO	
001338	6/27/96	RIFFLE	0	100	57.5	0.46	NO	
001339	6/27/96	DEEP POOL	0	100	8.8	1.77	NO	4.0
001340	6/27/96	RIFFLE	0	100	29.6	0.34	NO	2.6
001341	6/27/96	POOL	0	100	17.0	0.82	NO	2.4
001342	6/27/96	RIFFLE	0	100	6.3	0.12	NO	2.1
001343	6/27/96	POOL	0	100	16.6	0.67	DIVE	2.9
001344	6/27/96	RIFFLE	0	100	47.6	0.30	NO	4.1
001345	6/27/96	POOL	0	100	14.7	1.01	DIVE	4.7
001346	6/27/96	RUN	0	100	11.6	0.67	NO	4.9
001347	6/27/96	RIFFLE	0	100	12.0	0.12	NO	6.2
001348	6/27/96	POOL	0	100	21.8	0.82	NO	5.2
001349	6/27/96	RIFFLE	0	100	53.2	0.40	NO	3.0
001350	6/27/96	POOL	0	100	11.3	0.82	DIVE	3.7
001351	6/27/96	RIFFLE	0	100	51.0	0.40	NO	4.9
001352	6/27/96	POOL	0	100	16.4	0.94	DIVE	4.4
001353	6/27/96	POOL	0	100	21.9	0.85	NO	3.4
001354	6/27/96	RIFFLE	0	100	20.3	0.18	SHOCK	3.2
001355	6/27/96	POOL	0	100	13.3	0.49	DIVE	3.7
001356	6/27/96	POOL	0	100	15.5	1.13	NO	4.0
001357	6/27/96	RIFFLE	0	100	11.2	0.24	NO	4.4
001358	6/27/96	POOL	0	100	11.0	0.67	DIVE	5.0
001359	6/27/96	POOL	0	100	20.9	1.04	NO	4.3
001360	6/27/96	RIFFLE	0	100	8.4	0.21	NO	3.7
001361	6/27/96	POOL	0	100	27.9	0.61	NO	3.4
001362	6/27/96	RIFFLE	0	100	18.5	0.18	NO	3.8
001363	6/27/96	POOL	0	100	19.2	1.01	NO	3.4
001364	6/27/96	RIFFLE	0	100	6.0	0.15	SHOCK	2.3
001365	6/27/96	POOL	0	100	22.3	0.91	NO	2.9
001366	6/27/96	RIFFLE	0	100	26.4	0.24	NO	4.4
001367	6/27/96	RUN	0	100	14.7	0.55	DIVE	6.1
001368	6/27/96	RUN	0	100	35.7	0.67	NO	4.4
001369	6/27/96	RIFFLE	0	100	17.1	0.37	NO	4.1
001370	6/27/96	RUN	0	100	9.6	0.61	NO	4.4
001371	6/27/96	RIFFLE	0	100	17.6	0.61	NO	5.2
001372	6/27/96	POOL	0	100	12.5	0.61	NO	5.3
001373	6/27/96	RIFFLE	0	100	24.2	0.79	NO	2.1
001374	6/27/96	CASCADE	0	100	3.2	0.30	NO	1.3
001375	6/27/96	POOL	0	100	6.1	0.70	DIVE	1.7
001376	6/27/96	CASCADE	0	100	5.9	0.46	NO	1.4
001377	6/27/96	RIFFLE	0	100	5.7	0.18	NO	2.7
001378	6/27/96	POOL	0	100	9.7	0.70	NO	4.9
001379		RIFFLE	0	100	20.1	0.29	NO	4.7

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001380		RIFFLE	0	100	23.8	0.49	NO	3.5
001381		POOL	0	100	11.2	1.04	NO	2.6
001382		CASCADE	0	100	14.4	0.37	NO	3.0
001383		POOL	0	100	9.8	0.76	NO	4.6
001384		RIFFLE	0	100	19.9	0.34	NO	4.9
001385		POOL	0	100	13.0	1.25	NO	5.5
001386		RIFFLE	0	100	11.2	0.24	NO	4.1
001387		POOL	0	100	14.2	0.94	NO	4.9
001388		RIFFLE	0	100	20.1	0.46	NO	8.4
001389		RIFFLE	0	100	20.8	0.82	NO	6.1
001390		RIFFLE	0	100	25.7	0.34	SHOCK	3.8
001391		RUN	0	100	11.8	0.58	NO	3.4
001392		RIFFLE	0	100	20.0	0.40	NO	3.4
001393		RIFFLE	0	100	17.9	0.43	NO	4.7
001394		RIFFLE	0	100	12.8	0.67	NO	4.1
001395		RUN	0	100	12.6	0.67	NO	3.7
001396		RIFFLE	0	100	23.9	0.55	SHOCK	4.1
001397		RIFFLE	0	100	13.5	0.61	NO	3.0
001398		RIFFLE	0	100	21.0	0.43	NO	2.3
001399		RIFFLE	0	100	15.4	0.24	NO	3.5
001400		RUN	0	100	19.5	0.46	DIVE	3.7
001401		RIFFLE	0	100	23.7	0.37	NO	4.0
001402		RUN	0	100	16.6	0.43	NO	3.7
001403		RIFFLE	0	100	16.3	0.43	NO	2.6
001404		POOL	0	100	13.7	0.82	NO	2.0
001405		RIFFLE	0	100	21.1	0.37	NO	3.2
001406		RUN	0	100	7.7	0.46	DIVE	4.4
001407		RIFFLE	0	100	17.2	0.37	NO	3.5
001408		RIFFLE	0	100	21.3	0.18	NO	4.1
001409		RIFFLE	0	100	18.0	0.21	NO	3.8
001410		RUN	0	100	14.8	0.37	NO	3.7
001411		RIFFLE	0	100	21.8	0.24	NO	4.1
001412		RIFFLE	0	100	22.4	0.49	NO	4.6
001413		RIFFLE	0	100	20.4	0.34	NO	5.6
001414		RIFFLE	0	100	20.2	0.18	NO	5.0
001415		RIFFLE	0	100	21.0	0.24	NO	4.9
001416		RIFFLE	0	100	20.6	0.24	NO	4.9
001417		RIFFLE	0	100	20.3	0.24	NO	4.1
001418		RIFFLE	0	100	20.4	0.30	NO	4.7
001419		RIFFLE	0	100	20.7	0.27	NO	4.6
001420		RIFFLE	0	100	20.3	0.24	NO	3.7
001421		RIFFLE	0	100	20.6	0.34	NO	3.2
001422		RIFFLE	0	100	20.3	0.37	NO	2.9

HAB#	HDATE	HABTYPE	CHCODE	%FLOW	LEN	MMAX	D/S?	WIDTH
001423		RIFFLE	0	100	20.3	0.40	NO	3.8
001424		RIFFLE	0	100	22.9	0.40	NO	4.7
001425		RIFFLE	0	100	21.6	0.34	SHOCK	4.1
001426		RIFFLE	0	100	20.5	0.27	NO	4.1
001427		RIFFLE	0	100	20.4	0.18	SHOCK	4.3
001428		RIFFLE	0	100	22.1	0.40	NO	3.2
001429		RIFFLE	0	100	17.6	0.37	NO	4.1
001430		RIFFLE	0	100	21.4	0.40	NO	4.0
001431		POOL	0	100	15.5	0.70	DIVE	2.7
001432		RIFFLE	0	100	18.5	0.67	NO	

Table 22. Phase I dive data collected for the West Branch of Mill Creek during the 1996 summer survey. The variables gathered are defined as follows: HAB# is the habitat unit number selected for phase I sampling, DDATE is the date on which the phase I diving took place, SPP is the species encountered, HRDC1 is the Hard Count for the phase I sample, SFTC1 is the Soft Count for the phase I sample, CALIB? is whether or not the unit is selected for phase II sampling, HOW? is which method is selected for phase II sampling, DT1 is the time for the first dive pass, and DIVER is the person(s) who actually conducted the dive pass.

HAB#	DDATE	HABTYPE	SPP	HRDC1	SFTC1	CALIB?	HOW?	DT1	DIVER
001009	6/27/96	DEEP POOL	CHINOOK	4	0	YES	DIVE	403	GREGTA
001009	6/27/96	DEEP POOL	COHO	8	0	YES	DIVE	403	GREGTA
001009	6/27/96	DEEP POOL	TROUT	11	0	YES	DIVE	403	GREGTA
001012	6/27/96	POOL	CHINOOK	1	0	NO	NO	391	GREGTA
001012	6/27/96	POOL	COHO	3	0	NO	NO	391	GREGTA
001012	6/27/96	POOL	TROUT	12	0	NO	NO	391	GREGTA
001014	6/27/96	POOL	CHINOOK	1	0	NO	NO	302	JAMESR
001014	6/27/96	POOL	COHO	10	0	NO	NO	302	JAMESR
001014	6/27/96	POOL	TROUT	6	0	NO	NO	302	JAMESR
001016	6/27/96	POOL	CHINOOK	9	0	YES	DIVE	245	GREGTA
001016	6/27/96	POOL	COHO	1	0	YES	DIVE	245	GREGTA
001016	6/27/96	POOL	TROUT	7	0	YES	DIVE	245	GREGTA
001020	6/27/96	POOL	CHINOOK	15	0	YES	DIVE	900	PAULAL
001020	6/27/96	POOL	COHO	6	0	YES	DIVE	900	PAULAL
001020	6/27/96	POOL	TROUT	3	0	YES	DIVE	900	PAULAL
001024	6/27/96	POOL	CHINOOK	0	0	NO	NO	197	JAMESR
001024	6/27/96	POOL	COHO	28	0	NO	NO	197	JAMESR
001024	6/27/96	POOL	TROUT	24	0	NO	NO	197	JAMESR
001026	6/27/96	DEEP POOL	CHINOOK	7	0	YES	DIVE	452	JAMESR
001026	6/27/96	DEEP POOL	COHO	27	1	YES	DIVE	452	JAMESR
001026	6/27/96	DEEP POOL	TROUT	17	0	YES	DIVE	452	JAMESR
001041	7/12/96	POOL	CHINOOK	0	0	YES	DIVE	228	MIKECR
001041	7/12/96	POOL	COHO	11	0	YES	DIVE	228	MIKECR
001041	7/12/96	POOL	TROUT	7	0	YES	DIVE	228	MIKECR
001050	6/27/96	DEEP POOL	CHINOOK	5	0	YES	DIVE	1080	PAULAL
001050	6/27/96	DEEP POOL	COHO	142	0	YES	DIVE	1080	PAULAL
001050	6/27/96	DEEP POOL	TROUT	22	0	YES	DIVE	1080	PAULAL
001055	6/27/96	POOL	CHINOOK	2	0	NO	NO	411	GREGTA
001055	6/27/96	POOL	COHO	5	0	NO	NO	411	GREGTA
001055	6/27/96	POOL	TROUT	14	0	NO	NO	411	GREGTA
001056	6/27/96	DEEP POOL	CHINOOK	8	0	YES	DIVE	570	GREGTA
001056	6/27/96	DEEP POOL	COHO	31	0	YES	DIVE	570	GREGTA
001056	6/27/96	DEEP POOL	TROUT	11	0	YES	DIVE	570	GREGTA
001062	6/27/96	POOL	CHINOOK	6	0	NO	NO	241	GREGTA
001062	6/27/96	POOL	COHO	6	0	NO	NO	241	GREGTA
001062	6/27/96	POOL	TROUT	13	0	NO	NO	241	GREGTA
001067	6/27/96	DEEP POOL	CHINOOK	3	0	YES	DIVE	269	JAMESR

HAB#	DDATE	HABTYPE	SPP	HRDC1	SFTCI	CALIB?	HOW?	DT1	DIVER
001067	6/27/96	DEEP POOL	COHO	65	0	YES	DIVE	269	JAMESR
001067	6/27/96	DEEP POOL	TROUT	10	0	YES	DIVE	269	JAMESR
001071	6/27/96	RUN	CHINOOK	2	0	NO	NO	390	GREGTA
001071	6/27/96	RUN	COHO	5	0	NO	NO	390	GREGTA
001071	6/27/96	RUN	TROUT	22	0	NO	NO	390	GREGTA
001073	6/27/96	DEEP POOL	CHINOOK	3	0	YES	DIVE	524	GREGTA
001073	6/27/96	DEEP POOL	COHO	38	0	YES	DIVE	524	GREGTA
001073	6/27/96	DEEP POOL	TROUT	22	0	YES	DIVE	524	GREGTA
001078	6/28/96	POOL	CHINOOK	1	0	NO	NO	216	JAMESR
001078	6/28/96	POOL	COHO	21	0	NO	NO	216	JAMESR
001078	6/28/96	POOL	TROUT	10	0	NO	NO	216	JAMESR
001080	6/28/96	POOL	CHINOOK	1	0	NO	NO	238	MIKECR
001080	6/28/96	POOL	COHO	4	0	NO	NO	238	MIKECR
001080	6/28/96	POOL	TROUT	6	0	NO	NO	238	MIKECR
001085	6/28/96	DEEP POOL	CHINOOK	1	0	YES	DIVE	413	GREGTA
001085	6/28/96	DEEP POOL	COHO	37	0	YES	DIVE	413	GREGTA
001085	6/28/96	DEEP POOL	TROUT	20	0	YES	DIVE	413	GREGTA
001087	6/28/96	RUN	CHINOOK	2	0	YES	SHOCK	451	MIKECR
001087	6/28/96	RUN	COHO	35	3	YES	SHOCK	451	MIKECR
001087	6/28/96	RUN	TROUT	8	0	YES	SHOCK	451	MIKECR
001088	6/28/96	POOL	CHINOOK	0	0	NO	NO	102	JAMESR
001088	6/28/96	POOL	COHO	15	0	NO	NO	102	JAMESR
001088	6/28/96	POOL	TROUT	12	0	NO	NO	102	JAMESR
001089	6/28/96	RUN	CHINOOK	0	0	NO	NO	149	JAMESR
001089	6/28/96	RUN	COHO	9	0	NO	NO	149	JAMESR
001089	6/28/96	RUN	TROUT	8	0	NO	NO	149	JAMESR
001093	6/28/96	POOL	CHINOOK	3	0	YES	SHOCK	475	MIKECR
001093	6/28/96	POOL	COHO	56	3	YES	SHOCK	475	MIKECR
001093	6/28/96	POOL	TROUT	17	0	YES	SHOCK	475	MIKECR
001107	6/28/96	DEEP POOL	CHINOOK	0	0	YES	DIVE	236	JAMESR
001107	6/28/96	DEEP POOL	COHO	19	0	YES	DIVE	236	JAMESR
001107	6/28/96	DEEP POOL	TROUT	20	0	YES	DIVE	236	JAMESR
001109	6/28/96	POOL	CHINOOK	0	0	NO	NO	435	GREGTA
001109	6/28/96	POOL	COHO	25	0	NO	NO	435	GREGTA
001109	6/28/96	POOL	TROUT	10	0	NO	NO	435	GREGTA
001121	6/28/96	POOL	CHINOOK	0	0	NO	NO	331	MIKECR
001121	6/28/96	POOL	COHO	35	2	NO	NO	331	MIKECR
001121	6/28/96	POOL	TROUT	2	0	NO	NO	331	MIKECR
001129	6/28/96	DEEP POOL	CHINOOK	1	0	YES	DIVE	493	JAMESR
001129	6/28/96	DEEP POOL	COHO	58	0	YES	DIVE	493	JAMESR
001129	6/28/96	DEEP POOL	TROUT	25	0	YES	DIVE	493	JAMESR
001135	6/28/96	POOL	CHINOOK	1	0	NO	NO	555	GREGTA
001135	6/28/96	POOL	COHO	60	0	NO	NO	555	GREGTA
001135	6/28/96	POOL	TROUT	39	0	NO	NO	555	GREGTA
001140	6/28/96	POOL	CHINOOK	3	0	YES	SHOCK	465	GREGTA
001140	6/28/96	POOL	COHO	65	0	YES	SHOCK	465	GREGTA
001140	6/28/96	POOL	TROUT	24	0	YES	SHOCK	465	GREGTA

HAB#	DDATE	HABTYPE	SPP	HRDCI	SFTCI	CALIB?	HOW?	DTI	DIVER
001150	6/28/96	POOL	CHINOOK	3	1	NO	NO	312	MIKECR
001150	6/28/96	POOL	COHO	40	0	NO	NO	312	MIKECR
001150	6/28/96	POOL	TROUT	12	2	NO	NO	312	MIKECR
001164	7/11/96	RUN	CHINOOK	0	0	YES	SHOCK	714	MIKECR
001164	7/11/96	RUN	COHO	86	0	YES	SHOCK	714	MIKECR
001164	7/11/96	RUN	TROUT	10	0	YES	SHOCK	714	MIKECR
001167	7/11/96	POOL	CHINOOK	1	0	NO	NO	425	MIKECR
001167	7/11/96	POOL	COHO	67	0	NO	NO	425	MIKECR
001167	7/11/96	POOL	TROUT	10	0	NO	NO	425	MIKECR
001169	7/11/96	RUN	CHINOOK	0	0	YES	DIVE	307	MIKECR
001169	7/11/96	RUN	COHO	16	0	YES	DIVE	307	MIKECR
001169	7/11/96	RUN	TROUT	8	0	YES	DIVE	307	MIKECR
001171	7/11/96	RUN	CHINOOK	0	0	NO	NO	663	MIKECR
001171	7/11/96	RUN	COHO	44	0	NO	NO	663	MIKECR
001171	7/11/96	RUN	TROUT	1	0	NO	NO	663	MIKECR
001180	7/11/96	POOL	CHINOOK	0	0	NO	NO	385	MIKECR
001180	7/11/96	POOL	COHO	27	0	NO	NO	385	MIKECR
001180	7/11/96	POOL	TROUT	3	0	NO	NO	385	MIKECR
001188	7/11/96	DEEP POOL	CHINOOK	0	0	YES	DIVE	570	MIKECR
001188	7/11/96	DEEP POOL	COHO	88	0	YES	DIVE	570	MIKECR
001188	7/11/96	DEEP POOL	TROUT	14	0	YES	DIVE	570	MIKECR
001192	7/11/96	POOL	CHINOOK	0	0	NO	NO	274	MIKECR
001192	7/11/96	POOL	COHO	50	0	NO	NO	274	MIKECR
001192	7/11/96	POOL	TROUT	6	0	NO	NO	274	MIKECR
001197	7/11/96	POOL	CHINOOK	0	0	NO	NO	280	MIKECR
001197	7/11/96	POOL	COHO	50	0	NO	NO	280	MIKECR
001197	7/11/96	POOL	TROUT	7	0	NO	NO	280	MIKECR
001199	7/11/96	RUN	CHINOOK	0	0	NO	NO	289	MIKECR
001199	7/11/96	RUN	COHO	23	0	NO	NO	289	MIKECR
001199	7/11/96	RUN	TROUT	1	0	NO	NO	289	MIKECR
001202	7/11/96	POOL	CHINOOK	0	0	NO	NO	870	MIKECR
001202	7/11/96	POOL	COHO	76	0	NO	NO	870	MIKECR
001202	7/11/96	POOL	TROUT	10	0	NO	NO	870	MIKECR
001206	7/11/96	POOL	CHINOOK	0	0	NO	NO	480	MIKECR
001206	7/11/96	POOL	COHO	53	0	NO	NO	480	MIKECR
001206	7/11/96	POOL	TROUT	4	0	NO	NO	480	MIKECR
001212	7/11/96	POOL	CHINOOK	0	0	NO	NO	232	MIKECR
001212	7/11/96	POOL	COHO	51	0	NO	NO	232	MIKECR
001212	7/11/96	POOL	TROUT	3	0	NO	NO	232	MIKECR
001215	7/11/96	DEEP POOL	CHINOOK	0	0	YES	DIVE	460	MIKECR
001215	7/11/96	DEEP POOL	COHO	64	0	YES	DIVE	460	MIKECR
001215	7/11/96	DEEP POOL	TROUT	0	0	YES	DIVE	460	MIKECR
001218	7/11/96	POOL	CHINOOK	0	0	NO	NO	325	MIKECR
001218	7/11/96	POOL	COHO	79	0	NO	NO	325	MIKECR
001218	7/11/96	POOL	TROUT	3	0	NO	NO	325	MIKECR
001223	7/11/96	DEEP POOL	CHINOOK	0	0	YES	DIVE	339	MIKECR
001223	7/11/96	DEEP POOL	COHO	55	0	YES	DIVE	339	MIKECR

HAB#	DDATE	HABTYPE	SPP	HRDC1	SFTC1	CALIB?	HOW?	DT1	DIVER
001223	7/11/96	DEEP POOL	TROUT	1	0	YES	DIVE	339	MIKECR
001224	7/11/96	POOL	CHINOOK	0	0	NO	NO	197	MIKECR
001224	7/11/96	POOL	COHO	59	0	NO	NO	197	MIKECR
001224	7/11/96	POOL	TROUT	4	0	NO	NO	197	MIKECR
001227	7/11/96	RUN	CHINOOK	0	0	NO	NO	320	MIKECR
001227	7/11/96	RUN	COHO	51	0	NO	NO	320	MIKECR
001227	7/11/96	RUN	TROUT	3	0	NO	NO	320	MIKECR
001231	7/11/96	DEEP POOL	CHINOOK	0	0	YES	DIVE	283	MIKECR
001231	7/11/96	DEEP POOL	COHO	41	0	YES	DIVE	283	MIKECR
001231	7/11/96	DEEP POOL	TROUT	0	0	YES	DIVE	283	MIKECR
001237	7/11/96	POOL	CHINOOK	4	0	NO	NO	195	MIKECR
001237	7/11/96	POOL	COHO	5	0	NO	NO	195	MIKECR
001237	7/11/96	POOL	TROUT	2	0	NO	NO	195	MIKECR
001244	7/11/96	POOL	CHINOOK	0	0	YES	SHOCK	110	MIKECR
001244	7/11/96	POOL	COHO	31	0	YES	SHOCK	110	MIKECR
001244	7/11/96	POOL	TROUT	1	0	YES	SHOCK	110	MIKECR
001246	7/11/96	POOL	CHINOOK	1	0	NO	NO	260	MIKECR
001246	7/11/96	POOL	COHO	21	0	NO	NO	260	MIKECR
001246	7/11/96	POOL	TROUT	0	0	NO	NO	260	MIKECR
001251	7/11/96	POOL	CHINOOK	0	0	NO	NO	335	MIKECR
001251	7/11/96	POOL	COHO	160	0	NO	NO	335	MIKECR
001251	7/11/96	POOL	TROUT	11	0	NO	NO	335	MIKECR
001266	7/10/96	POOL	CHINOOK	0	0	NO	NO	559	MIKECR
001266	7/10/96	POOL	COHO	64	0	NO	NO	559	MIKECR
001266	7/10/96	POOL	TROUT	12	0	NO	NO	559	MIKECR
001268	7/10/96	RUN	CHINOOK	0	0	NO	NO	170	JAMESR
001268	7/10/96	RUN	COHO	20	0	NO	NO	170	JAMESR
001268	7/10/96	RUN	TROUT	3	0	NO	NO	170	JAMESR
001270	7/10/96	POOL	CHINOOK	0	0	NO	NO	275	JAMESR
001270	7/10/96	POOL	COHO	34	0	NO	NO	275	JAMESR
001270	7/10/96	POOL	TROUT	8	0	NO	NO	275	JAMESR
001273	7/10/96	RUN	CHINOOK	0	0	NO	NO	330	MIKECR
001273	7/10/96	RUN	COHO	35	0	NO	NO	330	MIKECR
001273	7/10/96	RUN	TROUT	5	0	NO	NO	330	MIKECR
001283	7/10/96	POOL	CHINOOK	0	0	YES	SHOCK	326	JAMESR
001283	7/10/96	POOL	COHO	46	0	YES	SHOCK	326	JAMESR
001283	7/10/96	POOL	TROUT	3	6	YES	SHOCK	326	JAMESR
001288	7/10/96	RUN	CHINOOK	0	0	NO	NO	120	MIKECR
001288	7/10/96	RUN	COHO	3	0	NO	NO	120	MIKECR
001288	7/10/96	RUN	TROUT	1	0	NO	NO	120	MIKECR
001291	7/10/96	RUN	CHINOOK	0	0	NO	NO	60	JAMESR
001291	7/10/96	RUN	COHO	0	0	NO	NO	60	JAMESR
001291	7/10/96	RUN	TROUT	1	0	NO	NO	60	JAMESR
001292	7/10/96	DEEP POOL	CHINOOK	0	0	YES	DIVE	199	MIKECR
001292	7/10/96	DEEP POOL	COHO	27	0	YES	DIVE	199	MIKECR
001292	7/10/96	DEEP POOL	TROUT	1	0	YES	DIVE	199	MIKECR
001293	7/10/96	POOL	CHINOOK	0	0	NO	NO	132	JAMESR

HAB#	DDATE	HABTYPE	SPP	HRDC1	SFTC1	CALIB?	HOW?	DT1	DIVER
001293	7/10/96	POOL	COHO	15	0	NO	NO	132	JAMESR
001293	7/10/96	POOL	TROUT	7	0	NO	NO	132	JAMESR
001297	7/10/96	RUN	CHINOOK	0	0	YES	DIVE	120	JAMESR
001297	7/10/96	RUN	COHO	4	0	YES	DIVE	120	JAMESR
001297	7/10/96	RUN	TROUT	6	0	YES	DIVE	120	JAMESR
001299	7/10/96	DEEP POOL	CHINOOK	0	0	YES	DIVE	238	MIKECR
001299	7/10/96	DEEP POOL	COHO	68	0	YES	DIVE	238	MIKECR
001299	7/10/96	DEEP POOL	TROUT	3	0	YES	DIVE	238	MIKECR
001307	7/10/96	POOL	CHINOOK	0	0	NO	NO	110	MIKECR
001307	7/10/96	POOL	COHO	8	0	NO	NO	110	MIKECR
001307	7/10/96	POOL	TROUT	1	0	NO	NO	110	MIKECR
001309	7/10/96	POOL	CHINOOK	0	0	NO	NO	309	JAMESR
001309	7/10/96	POOL	COHO	36	0	NO	NO	309	JAMESR
001309	7/10/96	POOL	TROUT	6	0	NO	NO	309	JAMESR
001311	7/10/96	RUN	CHINOOK	0	0	NO	NO	163	JAMESR
001311	7/10/96	RUN	COHO	7	0	NO	NO	163	JAMESR
001311	7/10/96	RUN	TROUT	1	0	NO	NO	163	JAMESR
001320	7/10/96	POOL	CHINOOK	0	0	NO	NO	184	MIKECR
001320	7/10/96	POOL	COHO	47	0	NO	NO	184	MIKECR
001320	7/10/96	POOL	TROUT	4	0	NO	NO	184	MIKECR
001326	7/10/96	POOL	CHINOOK	0	0	NO	NO	125	JAMESR
001326	7/10/96	POOL	COHO	14	0	NO	NO	125	JAMESR
001326	7/10/96	POOL	TROUT	10	0	NO	NO	125	JAMESR
001329	7/10/96	POOL	CHINOOK	0	0	NO	NO	132	JAMESR
001329	7/10/96	POOL	COHO	17	0	NO	NO	132	JAMESR
001329	7/10/96	POOL	TROUT	6	0	NO	NO	132	JAMESR
001333	7/10/96	POOL	CHINOOK	0	0	NO	NO	330	MIKECR
001333	7/10/96	POOL	COHO	14	0	NO	NO	330	MIKECR
001333	7/10/96	POOL	TROUT	2	0	NO	NO	330	MIKECR
001343	7/10/96	POOL	CHINOOK	0	0	YES	DIVE	171	MIKECR
001343	7/10/96	POOL	COHO	7	0	YES	DIVE	171	MIKECR
001343	7/10/96	POOL	TROUT	4	0	YES	DIVE	171	MIKECR
001345	7/10/96	POOL	CHINOOK	0	0	YES	DIVE	303	JAMESR
001345	7/10/96	POOL	COHO	18	0	YES	DIVE	303	JAMESR
001345	7/10/96	POOL	TROUT	10	0	YES	DIVE	303	JAMESR
001350	7/10/96	POOL	CHINOOK	0	0	YES	DIVE	178	MIKECR
001350	7/10/96	POOL	COHO	5	0	YES	DIVE	178	MIKECR
001350	7/10/96	POOL	TROUT	2	0	YES	DIVE	178	MIKECR
001352	7/10/96	POOL	CHINOOK	0	0	NO	NO	105	JAMESR
001352	7/10/96	POOL	COHO	8	0	NO	NO	105	JAMESR
001352	7/10/96	POOL	TROUT	11	0	NO	NO	105	JAMESR
001355	7/10/96	POOL	CHINOOK	0	0	YES	DIVE	219	MIKECR
001355	7/10/96	POOL	COHO	4	0	YES	DIVE	219	MIKECR
001355	7/10/96	POOL	TROUT	2	0	YES	DIVE	219	MIKECR
001358	7/10/96	POOL	CHINOOK	0	0	YES	DIVE	121	JAMESR
001358	7/10/96	POOL	COHO	0	0	YES	DIVE	121	JAMESR
001358	7/10/96	POOL	TROUT	5	0	YES	DIVE	121	JAMESR

HAB#	DDATE	HABTYPE	SPP	HRDC1	SFTC1	CALIB?	HOW?	DT1	DIVER
001367	7/10/96	RUN	CHINOOK	0	0	NO	NO	187	MIKECR
001367	7/10/96	RUN	COHO	0	0	NO	NO	187	MIKECR
001367	7/10/96	RUN	TROUT	2	0	NO	NO	187	MIKECR
001375	7/10/96	POOL	CHINOOK	0	0	NO	NO	136	MIKECR
001375	7/10/96	POOL	COHO	0	0	NO	NO	136	MIKECR
001375	7/10/96	POOL	TROUT	2	0	NO	NO	136	MIKECR
001400	7/10/96	RUN	CHINOOK	0	0	NO	NO	217	JAMESR
001400	7/10/96	RUN	COHO	0	0	NO	NO	217	JAMESR
001400	7/10/96	RUN	TROUT	4	0	NO	NO	217	JAMESR
001406	7/12/96	RUN	CHINOOK	0	0	YES	DIVE	189	MIKECR
001406	7/12/96	RUN	COHO	0	0	YES	DIVE	189	MIKECR
001406	7/12/96	RUN	TROUT	3	0	YES	DIVE	189	MIKECR
001431	7/10/96	POOL	CHINOOK	0	0	NO	NO	206	JAMESR
001431	7/10/96	POOL	COHO	0	0	NO	NO	206	JAMESR
001431	7/10/96	POOL	TROUT	6	0	NO	NO	206	JAMESR

Table 23. Phase I and phase II electrofishing data collected for the West Branch of Mill Creek during the 1996 summer survey. The variables gathered are defined as follows: HAB# is the habitat unit number selected for phase I or phase II sampling; SDATE is the date on which the electrofishing took place; SPP is the species encountered; and PASS1, PASS2, and PASS3 are the total numbers of fish captured for each electrofishing pass.

HAB#	SDATE	HABTYPE	SPP	PASS1	PASS2	PASS3
001037	7/2/96	RIFFLE	CHINOOK	0	0	0
001037	7/2/96	RIFFLE	COHO	1	0	1
001037	7/2/96	RIFFLE	TROUT	0	0	0
001051	7/2/96	RIFFLE	CHINOOK	0	0	0
001051	7/2/96	RIFFLE	COHO	0	0	0
001051	7/2/96	RIFFLE	TROUT	0	0	0
001087	7/2/96	RUN	CHINOOK	0	0	0
001087	7/2/96	RUN	COHO	14	17	9
001087	7/2/96	RUN	TROUT	6	5	3
001092	7/3/96	RIFFLE	CHINOOK	0	0	0
001092	7/3/96	RIFFLE	COHO	2	1	2
001092	7/3/96	RIFFLE	TROUT	10	3	3
001093	7/3/96	POOL	CHINOOK	0	0	1
001093	7/3/96	POOL	COHO	6	6	3
001093	7/3/96	POOL	TROUT	8	9	4
001122	7/3/96	RIFFLE	CHINOOK	0	0	0
001122	7/3/96	RIFFLE	COHO	7	1	0
001122	7/3/96	RIFFLE	TROUT	6	1	1
001140	7/3/96	POOL	CHINOOK	0	0	0
001140	7/3/96	POOL	COHO	17	11	7
001140	7/3/96	POOL	TROUT	3	3	1
001141	7/3/96	RIFFLE	CHINOOK	0	0	0
001141	7/3/96	RIFFLE	COHO	0	1	0
001141	7/3/96	RIFFLE	TROUT	0	0	0
001155	7/12/96	RIFFLE	CHINOOK	0	0	0
001155	7/12/96	RIFFLE	COHO	1	0	0
001155	7/12/96	RIFFLE	TROUT	1	0	0
001164	7/12/96	RUN	CHINOOK	0	0	0
001164	7/12/96	RUN	COHO	43	20	21
001164	7/12/96	RUN	TROUT	14	11	3
001171	7/12/96	RIFFLE	CHINOOK	0	0	0
001171	7/12/96	RIFFLE	COHO	6	0	0
001171	7/12/96	RIFFLE	TROUT	0	0	0
001207	7/12/96	RIFFLE	CHINOOK	0	0	0
001207	7/12/96	RIFFLE	COHO	0	0	0
001207	7/12/96	RIFFLE	TROUT	0	0	0
001225	7/12/96	RIFFLE	CHINOOK	0	0	0
001225	7/12/96	RIFFLE	COHO	31	17	19

HAB#	SDATE	HABTYPE	SPP	PASS1	PASS2	PASS3
001225	7/12/96	RIFFLE	TROUT	0	1	0
001244	7/12/96	POOL	CHINOOK	0	0	0
001244	7/12/96	POOL	COHO	12	3	3
001244	7/12/96	POOL	TROUT	1	0	0
001283	7/12/96	POOL	CHINOOK	0	0	0
001283	7/12/96	POOL	COHO	18	13	5
001283	7/12/96	POOL	TROUT	1	3	1
001286	7/9/96	RIFFLE	CHINOOK	0	0	0
001286	7/9/96	RIFFLE	COHO	0	0	0
001286	7/9/96	RIFFLE	TROUT	0	0	0
001289	7/9/96	RIFFLE	CHINOOK	0	0	0
001289	7/9/96	RIFFLE	COHO	0	0	0
001289	7/9/96	RIFFLE	TROUT	0	0	1
001354	7/9/96	RIFFLE	CHINOOK	0	0	0
001354	7/9/96	RIFFLE	COHO	0	0	0
001354	7/9/96	RIFFLE	TROUT	0	0	0
001364	7/9/96	RIFFLE	CHINOOK	0	0	0
001364	7/9/96	RIFFLE	COHO	0	0	0
001364	7/9/96	RIFFLE	TROUT	0	0	0
001390	7/9/96	RIFFLE	CHINOOK	0	0	0
001390	7/9/96	RIFFLE	COHO	0	0	0
001390	7/9/96	RIFFLE	TROUT	2	2	0
001396	7/9/96	RIFFLE	CHINOOK	0	0	0
001396	7/9/96	RIFFLE	COHO	1	0	0
001396	7/9/96	RIFFLE	TROUT	11	3	1
001425	7/9/96	RIFFLE	CHINOOK	0	0	0
001425	7/9/96	RIFFLE	COHO	0	0	0
001425	7/9/96	RIFFLE	TROUT	0	0	0
001427	7/9/96	RIFFLE	CHINOOK	0	0	0
001427	7/9/96	RIFFLE	COHO	0	0	0
001427	7/9/96	RIFFLE	TROUT	1	0	0

Table 24. Phase II dive data collected for the West Branch of Mill Creek during the 1996 summer survey. The variables gathered are defined as follows: HAB# is the habitat unit number selected for phase I sampling; DDATE is the date on which the phase II diving took place; SPP is the species encountered; HRDC2 and HRDC3 are the Hard Counts for dive passes two and three, respectively, for the phase II sample; SFTC2 and SFTC3 are the Soft Counts for dive passes two and three, respectively, for the phase II sample; DT2 and DT3 are the times for the second and third dive passes, respectively; and DIVER is the person(s) who actually conducted the dive pass.

HAB#	DDATE	HABTYPE	SPP	HRDC2	SFTC2	DT2	HRDC3	SFTC3	DT3	DIVER
001009	6/27/96	DEEP POOL	COHO	7	0	467	10	0	552	GREGTA
001009	6/27/96	DEEP POOL	CHINOOK	5	0	467	6	0	552	GREGTA
001009	6/27/96	DEEP POOL	TROUT	15	0	467	17	0	552	GREGTA
001016	6/27/96	POOL	TROUT	9	0	276	9	0	238	GREGTA
001016	6/27/96	POOL	COHO	1	0	276	1	0	238	GREGTA
001016	6/27/96	POOL	CHINOOK	7	0	276	9	0	238	GREGTA
001020	6/27/96	POOL	TROUT	4	0	660	6	0	480	PAULAL
001020	6/27/96	POOL	COHO	9	0	660	8	0	480	PAULAL
001020	6/27/96	POOL	CHINOOK	19	0	660	15	0	480	PAULAL
001026	6/27/96	DEEP POOL	TROUT	10	0	398	15	0	395	JAMESR
001026	6/27/96	DEEP POOL	COHO	30	0	398	36	0	395	JAMESR
001026	6/27/96	DEEP POOL	CHINOOK	8	0	398	6	0	395	JAMESR
001041	7/12/96	POOL	TROUT	8	0	227	10	0	272	MIKECR
001041	7/12/96	POOL	COHO	12	0	227	8	0	272	MIKECR
001041	7/12/96	POOL	CHINOOK	1	0	227	2	0	272	MIKECR
001050	6/27/96	DEEP POOL	TROUT	25	0	930	21	0	1035	PAULAL
001050	6/27/96	DEEP POOL	COHO	135	0	930	138	0	1035	PAULAL
001050	6/27/96	DEEP POOL	CHINOOK	8	0	930	7	0	1035	PAULAL
001056	6/27/96	DEEP POOL	TROUT	13	0	530	14	0	465	GREGTA
001056	6/27/96	DEEP POOL	COHO	30	0	530	32	0	465	GREGTA
001056	6/27/96	DEEP POOL	CHINOOK	8	0	530	9	0	465	GREGTA
001067	6/27/96	DEEP POOL	TROUT	10	0	260	10	0	224	JAMESR
001067	6/27/96	DEEP POOL	COHO	60	0	260	57	0	224	JAMESR
001067	6/27/96	DEEP POOL	CHINOOK	3	0	260	2	0	224	JAMESR
001073	6/27/96	DEEP POOL	TROUT	29	0	597	26	0	537	GREGTA
001073	6/27/96	DEEP POOL	COHO	44	0	597	33	0	537	GREGTA
001073	6/27/96	DEEP POOL	CHINOOK	3	0	597	3	0	537	GREGTA
001085	6/28/96	DEEP POOL	TROUT	24	0	480	24	0	472	GREGTA
001085	6/28/96	DEEP POOL	COHO	42	0	480	39	0	472	GREGTA
001085	6/28/96	DEEP POOL	CHINOOK	1	0	480	1	0	472	GREGTA
001107	6/28/96	DEEP POOL	TROUT	21	0	200	22	0	220	JAMESR
001107	6/28/96	DEEP POOL	COHO	27	0	200	22	0	220	JAMESR
001107	6/28/96	DEEP POOL	CHINOOK	1	0	200	1	0	220	JAMESR
001129	6/28/96	DEEP POOL	TROUT	19	0	548	20	0	529	JAMESR
001129	6/28/96	DEEP POOL	COHO	67	0	548	67	0	529	JAMESR
001129	6/28/96	DEEP POOL	CHINOOK	1	0	548	2	0	529	JAMESR
001169	7/11/96	RUN	TROUT	5	0	307	5	0	325	MIKECR
001169	7/11/96	RUN	COHO	18	0	307	19	0	325	MIKECR

HAB#	DDATE	HABTYPE	SPP	HRDC2	SFTC2	DT2	HRDC3	SFTC3	DT3	DIVER
001169	7/11/96	RUN	CHINOOK	0	0	307	0	0	325	MIKECR
001188	7/11/96	DEEP POOL	TROUT	12	0	531	12	0	615	MIKECR
001188	7/11/96	DEEP POOL	COHO	91	0	531	94	0	615	MIKECR
001188	7/11/96	DEEP POOL	CHINOOK	0	0	531	1	0	615	MIKECR
001215	7/11/96	DEEP POOL	TROUT	1	0	499	1	0	510	MIKECR
001215	7/11/96	DEEP POOL	COHO	61	0	499	75	0	510	MIKECR
001215	7/11/96	DEEP POOL	CHINOOK	0	0	499	0	1	510	MIKECR
001223	7/11/96	DEEP POOL	TROUT	2	0	318	3	0	360	MIKECR
001223	7/11/96	DEEP POOL	COHO	64	0	318	65	0	360	MIKECR
001223	7/11/96	DEEP POOL	CHINOOK	0	0	318	0	0	360	MIKECR
001231	7/11/96	DEEP POOL	TROUT	0	0	337	1	0	330	MIKECR
001231	7/11/96	DEEP POOL	COHO	42	0	337	43	0	330	MIKECR
001231	7/11/96	DEEP POOL	CHINOOK	0	0	337	0	0	330	MIKECR
001292	7/10/96	DEEP POOL	TROUT	1	0	199	1	0	230	MIKECR
001292	7/10/96	DEEP POOL	COHO	27	0	199	37	0	230	MIKECR
001292	7/10/96	DEEP POOL	CHINOOK	0	0	199	0	0	230	MIKECR
001297	7/10/96	RUN	TROUT	5	0	115	2	0	104	JAMESR
001297	7/10/96	RUN	COHO	5	0	115	3	0	104	JAMESR
001297	7/10/96	RUN	CHINOOK	0	0	115	0	0	104	JAMESR
001299	7/10/96	DEEP POOL	TROUT	2	0	190	3	0	207	MIKECR
001299	7/10/96	DEEP POOL	COHO	65	0	190	54	0	207	MIKECR
001299	7/10/96	DEEP POOL	CHINOOK	0	0	190	0	0	207	MIKECR
001343	7/10/96	POOL	TROUT	3	0	165	4	0	185	MIKECR
001343	7/10/96	POOL	COHO	11	0	165	12	0	185	MIKECR
001343	7/10/96	POOL	CHINOOK	0	0	165	0	0	185	MIKECR
001345	7/10/96	POOL	TROUT	11	0	159	12	0	188	JAMESR
001345	7/10/96	POOL	COHO	13	0	159	13	0	188	JAMESR
001345	7/10/96	POOL	CHINOOK	0	0	159	0	0	188	JAMESR
001350	7/10/96	POOL	TROUT	3	0	159	8	0	154	MIKECR
001350	7/10/96	POOL	COHO	5	0	159	6	0	154	MIKECR
001350	7/10/96	POOL	CHINOOK	0	0	159	0	0	154	MIKECR
001355	7/10/96	POOL	TROUT	0	0	127	2	0	122	MIKECR
001355	7/10/96	POOL	COHO	4	0	127	5	0	122	MIKECR
001355	7/10/96	POOL	CHINOOK	0	0	127	0	0	122	MIKECR
001358	7/10/96	POOL	TROUT	7	0	119	6	0	108	JAMESR
001358	7/10/96	POOL	COHO	1	0	119	1	0	108	JAMESR
001358	7/10/96	POOL	CHINOOK	0	0	119	0	0	108	JAMESR
001406	7/12/96	RUN	TROUT	3	0	133	3	0	130	MIKECR
001406	7/12/96	RUN	COHO	0	0	133	0	0	130	MIKECR
001406	7/12/96	RUN	CHINOOK	0	0	133	0	0	130	MIKECR

Table 25. Elapsed times for the electrofishing passes for the West Branch of Mill Creek during the 1996 summer survey. The variables gathered are defined as follows: HAB# is the habitat unit number selected for phase I or phase II sampling; SDATE is the date on which the electrofishing took place; TIME1, TIME2, and TIME3 are the total elapsed times of electrofishing for the first, second, and third passes, respectively; OPERAT is the person who actually conducted the electrofishing pass.

HAB#	SDATE	HABTYPE	TIME1	TIME2	TIME3	OPERAT
001037	7/2/96	RIFFLE	183	181	175	CHRISM
001051	7/2/96	RIFFLE	230	234		MIKECR
001087	7/2/96	RUN	663	653	594	MIKECR
001087	7/2/96	RUN	470	580	586	PAULAB
001092	7/3/96	RIFFLE	498	583	531	GREGTA
001093	7/3/96	POOL	280	303	325	MIKECR
001093	7/3/96	POOL	583	694	604	CHRISM
001122	7/3/96	RIFFLE	357	337	388	CHRISM
001140	7/3/96	POOL	268	369	343	CHRISM
001140	7/3/96	POOL	342	374	318	GREGTA
001141	7/3/96	RIFFLE	352	354	384	MIKECR
001155	6/12/96	RIFFLE	85	80	83	CHRISM
001164	6/12/96	RUN	1140	998	991	CHRISM
001164	6/12/96	RUN	550	512	552	PAULAB
001171	7/12/96	RIFFLE	98	101	95	CHRISM
001207	7/12/96	RIFFLE	118	114	119	CHRISM
001225	7/12/96	RIFFLE	322	332	344	CHRISM
001244	7/11/96	POOL	484	385		CHRISM
001283	7/12/96	POOL	400	466	536	CHRISM
001286	7/9/96	RIFFLE	129	135	131	CHRISM
001289	7/9/96	RIFFLE	38	36	42	CHRISM
001354	7/9/96	RIFFLE	240	253	238	MIKECR
001364	7/9/96	RIFFLE	15	11	17	CHRISM
001390	7/9/96	RIFFLE	257	269		MIKECR
001396	7/9/96	RIFFLE	426	407		CHRISM
001396	7/9/96	RIFFLE	71	66	90	MIKECR
001425	7/8/96	RIFFLE	288	275	279	MIKECR
001427	7/8/96	RIFFLE	221	227	252	CHRISM

12308

From: Bill Jong
To: Moyer, Chris
Date: 2/21/2006 3:49:01 PM
Subject: Chris: I was looking at your HSU master thesis and I have a couple of questions

I hope this finds you well,

I am working on the states coho salmon status review. Part of the effort is to compile a coho presence by brood year table for 1979 thru 2002. We're interested in painting the sampling history for coho streams then assembling a spp comp table for each stream for each brood year which is why we are reading your thesis.

In Table 1, Bummer Lake Creek is listed as abundance sampled in 1996 but I cannot find any further mention of your findings except in the caption to Table 6. If I missed the results (and I do have pretty bad vision...), can you tell me which page(s) to look. If not, did you find coho yoy and trout in Bummer in 96?

Were any coho yearlings observed - if so, which creeks and which years?

Were chinook only observed in West Branch Mill Creek in 1996?

This is how we've condensed your findings:

Year = 1995

WB Mill Creek - coho yoy, trout

EF Mill Creek - coho yoy, trout

Bummer Lk Creek - Trout

Ah Pah Creek - coho yoy, trout

Canon Creek - coho yoy, trout

Wilson Creek - coho yoy, trout

SF Winchuck River - Trout

Year = 1996

WB Mill Creek - coho yoy, trout, chinook

EF Mill Creek - coho yoy, trout

Bummer Lk Creek - ?

Clarks Creek - coho yoy, trout

Prairie Creek - coho yoy

Any help you can provide would be appreciated. Thanks

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Bill Jong

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Tara/Anne: let's wait for a response BT

1995			1996	
015.00 West Branch Mill Creek	Coho yoy, trout	Table 6	Coho yoy, trout, Chin	Table 6, 20, 22, 23
013.00 East Fork Mill Creek	Coho yoy, trout	Table 6	Coho yoy, trout	Table 6
014.00 Bummer Lake Creek	Trout	Table 10	MIA	
068.00 Ah Pah Creek	Coho yoy, trout	Table 6, 20		
205.00 Canon Creek	Coho yoy, trout	Table 6		
049.00 Wilson Creek	Coho yoy, trout	Table 6		
001.00 SF Winchuck River	Trout	Table 6		
011.03 Clarks Creek			Coho yoy, trout	Table 20
165.00 Prairie Creek			Coho yoy	Table 6