Final Report

January 1998 – September 2001

GENETIC MAINTENANCE OF HATCHERY- AND NATURAL-ORIGIN WINTER-RUN CHINOOK SALMON

COOPERATIVE AGREEMENT

ANADROMOUS FISH RESTORATION PROGRAM

University of California–Davis/U.S. Fish & Wildlife Service

1448-11330-97-J194	1 / 1 / 98-12 / 31 / 98
1448-11330-97-J045	1 / 1 / 99-12 / 31 / 99
1448-11330-97-J045	1 / 1 / 00-12 / 31 / 00
1448-11330-97-J094	1 / 1 / 01-09 / 30 / 01

Contributers:

Principal Investigators: Dennis Hedgecock (1998-2001)

Michael Banks (1998)

Research Associate: Vanessa Rashbrook (1998-2001)

Postgraduate Researchers: Heather Fitzgerald (1998)

Stephen Sabatino (1999-2001)

Dimitri Churikov (2001)

Computer Programmer: Will Eichert (1999-2001)

Subcontract: Phil Hedrick (Arizona State University) (1998-2001)

CONTENTS

Introduction

This report summarizes four years of research conducted at the University of California's (Davis) Bodega Marine Laboratory (BML) in cooperation with the U.S. Fish and Wildlife Service (USFWS) at Red Bluff, and the Coleman (CNFH) and Livingston Stone (LSNFH) National Fish Hatcheries. The major objectives of the study were to identify individual salmon, using established nuclear DNA markers, for use in the USFWS's winter-run chinook salmon captive propagation / broodstock program, and to determine genetic impacts of the program on the wild population by verifying the effective population size model.

The major accomplishments of this project, which have largely been published in peer reviewed journals (see Publications section), are:

(1) the implementation of molecular and statistical methods that can reliably assign individuals to the winter chinook population at any stage of the life cycle;
(2) the marked reduction of the risk of hybridizing winter and non-winter chinook in the USFWS's supplementation program by genotyping potential broodstock before hatchery spawning;
(3) the development, implementation, and validation of a population genetic model for predicting the effect of the hatchery program on the effective size and genetic diversity of winter chinook;
(4) the enumeration of winter chinook among carcasses recovered on the spawning grounds and among outmigrating juveniles caught at the Red Bluff Diversion Dam.

Progress on the various tasks stipulated in the 1998-2001 cooperative agreements are summarized under the following headings: Molecular Markers used in Winter-Run Discrimination and Family Analysis; Computer Programs; LOD Selection Criteria; Sacramento River and Battle Creek Trapping; Estimation of Effective Population Size (N_e); and Effect of Releases from the Captive Broodstock: The Tripartite Model. This arrangement is somewhat chronological and traces the development of methods used to address overall project objectives.

1. Molecular Markers used in Winter-Run Discrimination and Family Analysis

Microsatellites. Over the last few years a number of dinucleotide repeat microsatellite markers have been developed at BML. We have also screened and optimized microsatellites, often developed for other salmonid species, produced by other labs. These markers were evaluated for Mendelian inheritance using families produced by the winter-run broodstock (Banks et al. 1999) and used to assess genetic diversity of chinook salmon runs in California's Central Valley (Banks et al. 2000). A suite of seven markers (dinucleotides: *Ots-2, -3, -9, -10,* (Banks et al. 1999), *Oneμ13* (Scribner et al. 1996); tetranucleotides: *Ots-104, -107* (Nelson & Beacham 1999)) were selected for their diagnostic power to distinguish winter run from the other four populations (spring-Butte, spring-Deer / Mill, fall and late fall) and multiplexed to increase their efficiency for common use (Greig & Banks 1999).

Identification of broodstock families. A further set of tetranucleotide markers (the '200-series') were developed at BML to discriminate spring from other runs (Greig & Banks, in prep.). Not only are these microsatellites also extremely diagnostic for winter run they are, in addition, more polymorphic within winter run than the dinucleotide microsatellites, thus providing a means of distinguishing among winter-run family groups. These additional tools will be invaluable for advising the Service on combining broodstock families prior to their release as smolts, and in identifying the families of returning spawners.

Allele standardization. We participated in a Pacific coast-wide endeavor to standardize allele sizing and scoring among labs and across instrument collection platforms. The aim was to facilitate data sharing among labs studying chinook salmon throughout the Pacific Northwest and, ultimately, recommend a core set of microsatellite loci to be used by the entire salmon research community. Allele standards ('ladders') were constructed and tested for *Ots-2, -3* and *-107*. However, due to the diverse nature of the research undertaken by different labs (some pertaining to ocean stock structures, others to specific conservation efforts), the need for a shared set of core loci did not materialize. Nonetheless, a complete summary of all loci used by all labs (detailing primer sequences, Genbank accession numbers, PCR protocols, numbers of individuals and populations studied, number of alleles encountered, allele size range, multiplexing details, and any evidence of null alleles and non-mendelian transmission), was assembled and can be accessed on the American Fisheries Society web page (http://www.fisheries.org/genetics/Primers/Salmonid_Microsat.htm).

Major histocompatibility complex (MHC). Progress has been made on establishing a new type of marker – the Major Histocompatibility Complex (MHC) locus – for discrimination among chinook runs. Kim et al. (1999) used SSCP technique to characterize the Central Valley chinook runs and, with the exception of fall and late fall, determined significant frequency differences among runs. SNP (single nucleotide polymorphism) analysis (via Sequenom's MALDI-TOF technique) of a selection of the baseline samples representing the five Central Valley chinook populations has confirmed that MHC is highly diagnostic. Since our attempts to use molecular beacons to type this locus were unsuccessful, we have been pursuing alternative approaches.

2. Computer Programs

A total of four computer programs have been developed at BML.

WHICHRUN. Program description: http://www-bml.ucdavis.edu/whichrun.htm, see also Banks and Eichert (2000). WHICHRUN is a program for population assignment of individuals based on multilocus genotype data. It requires baseline genotype data for all potential source populations, as well as genotype data for candidate individuals for which population origin is to be determined.

WHICHLOCUS. Program description: http://www-bml.ucdavis.edu/whichloci.htm. This program uses the same population assignment techniques as WHICHRUN, but iterates these assignments over a user-specified number of resampled datasets (derived from a population baseline file) of user-specified size. By generating statistics for these assignments it determines empirically the number and type of loci required to match user-specified accuracy criteria for population assignment. It helps researchers to determine which loci should be used to reach desired discrimination accuracy for selected populations.

Population assignment is made when the $\log_{10}$ of a likelihood ratio equals or exceeds a user-specified stringency. The likelihood ratio (also called the assignment ratio) in both WHICHRUN and WHICHLOCI was originally calculated using what is now called the 'Next Most Likely' method, as follows:

likelihood = P(most likely population) / P(next most likely population) or, if using the Critical Population Method (which permits the researcher to choose a specific run e.g., winter) likelihood = P(critical population e.g., winter) / P(most likely population except for critical population).

The likelihood ratio may now be calculated based on an average probability of all other populations:

likelihood = (total # populations - 1) * P(most likely population) / (sum(P(all other populations)) or, if using the Critical Population Method, likelihood = (total # populations - 1) * P(critical population) / (sum(P(all other populations)).

Thus, WHICHRUN can be modified depending on needs. For example, in selecting winter-run broodstock, we err on the side of caution by choosing the “probability of the next most likely population” as the denominator in the likelihood ratio, thus increasing the risk of rejecting fish even if they are genuinely winter (type I error). On the other hand, in estimating the number of true winter run individuals in carcass and juvenile samples, we err on the side of including fish that may be non-winter (type II error) by selecting the “average likelihood of all other populations” as the denominator.

<u>WHICHPARENT.</u> An application that uses multilocus genotype data for offspring and possible parents, and optionally a mating history record of the possible parents, to identify the most likely parents of individual offspring. The program first finds all possible parents of an offspring by identifying parents that share at least one allele at every locus with the offspring. The program then examines all possible parental pairs, looking for pairs where the parental genotype pair could have produced the offspring genotype at every locus, and identifies these pairs as "calculated crosses". Lastly, the program checks

these parental pairs in the mating history file (if parental mating history is available) to verify that these fish were mated, and if so, identifies these parental pairs as "crosses from mating history file". An option is provided to allow a "miss" at one or more loci, meaning that one or more of the offspring's alleles was not found at a particular locus in the putative parental pair. This option is useful in cases where an allele size may have been misidentified.

SIBLINGS. An application that reconstructs the genotypes of the unknown parents of full sibling groups. Briefly, the input file accepts rough estimates of sibling groups. The sibling group estimates are parsed from a kinship matrix produced by the program "Kinship" (Goodnight software, http://gsoft.smu.edu/GSoft.html), based on the significance of relatedness scores between pairs of individuals. Alternatively, the sibling group estimates may be arrived at in some other manner by the researcher (such as allele-sharing trees), and entered into a sibling group file that is accepted as input to our Siblings program. These estimates are refined by allocation into groups approaching the actual sibling groups. Fish that cannot belong to a sibgroup according to Mendelian laws of inheritance are discarded from that group, and sibling groups that are found to be full siblings of other sibling groups are combined. The most likely parental mating pair that produced each sibling group is then constructed. This program is used to correct juvenile samples for the biases resulting from relatedness. Members of sibling groups within juvenile samples are replaced with their putative parents. This technique was employed by Banks et al. (2000) to correct samples of spring-run juveniles used in the assessment of genetic structure of Central Valley chinook.

3. LOD Selection Criteria

Simulations using WHICHLOCUS. The DNA from carcasses as well as juveniles collected as mortalities in screw traps is often degraded, hence PCR amplification is poor. Consequently, individuals with missing genotypes at many or all of the 7 core loci are common in these data sets. Rather than include individuals with insufficient data and run the risk of incorrect run assignment, or discard individuals because of incomplete data and lose potentially valuable information, we tested which loci we could exclude from the data set and still remain within acceptable bounds of risk of misdiagnosis. Given that these data are used by USFWS to estimate more accurately winter run escapement, we decided it was more acceptable to include non-winter fish as winter (type II error) than to reject fish that are genuinely winter (type I error).

We used the program WHICHLOCUS as a tool to investigate this problem. We conducted simulations by permuting the baseline database (consisting of the five populations of chinook salmon occurring in the Sacramento / San Joaquin watershed) and systematically testing the 127 combinations of 1 to 6 loci, noting the % correct assignment to winter and % incorrect assignment of non-winter to winter. We set parameters of LOD>0 and made 1000 iterations of the permuted populations of n=500. The best possible assignment is, naturally, obtained using all 7 loci (99.73% correct assignment, 0.47% mis-assignment), and this is our yardstick. It appears that, while *Ots-2* is the best marker for correct winter run assignment; e.g., *Ots-2* alone correctly assigns 95.28% of permuted winter-run back to winter, it is not the best for minimizing mis-assignment (22.97%). Locus *Oneμ13*, which has 88.20% correct assignment, is more stringent, producing a very low mis-assignment of 2.58%. Together, these two loci produce correct / mis-assignment values of 97.15% and 4.82%, respectively. A criterion of >95% correct assignment, coupled with <5% mis-assignment, was selected. By examining the correct / mis-assignment scores for each combination of loci in turn, we were able to assess acceptable error and develop a set of rules (known as the 'critical loci combination') under which individuals missing certain loci from the complete complement of 7 could be retained in the data set without compromising winter-run assignment estimates:

Number of loci:	Fate of individual:
1	discard
2	accept only if *Ots-2* & *Oneμ13*
3	accept any with *Oneμ13* OR *Ots-2* & *Ots-104* & *Ots-107*
4	accept any with *Oneμ13* OR *Ots-2* & *Ots-104* OR *Ots-2* & *Ots-107*
5	accept all combinations
6	accept all combinations

Analysis of Sacramento River carcasses. From April or May (depending on the year) through August, the period of winter-run return and spawn, USFWS personal collected carcasses from the Sacramento River main stem. We used Puregene DNA isolation kits to extract DNA from each sample and genotyped individuals at 7 loci in triplicate to ensure quality control. A complete list of all carcass samples (1995-2000) received by BML, together with their LOD score and run assignment (where applicable), is given in Appendix A. The final data set, used to estimate winter-run effective population size (see section 5), considers only those individuals with sufficient genotype information for analysis (Table 1).

Table 1. Summary of carcass analyses, 1995-2000 (7 loci).

Year	samples received	ad clipped (hatchery)	no PCR amp	w / out critical loci	samples analyzed	WHICRUN % Winter @ LOD			MSA proportion winter
						>0	>1	>2	
1995	110	0	37	34	39	97.4	94.9	94.9	0.967
1996	89	0	10	32	47	74.5	72.3	72.3	0.788
1997	204	5	36	39	124	95.2	94.4	88.7	0.953
1998	590	4	40	36	510	96.3	94.7	91.2	0.921
1999	323	7	15	30	271	89.3	89.3	88.9	0.891
2000	715	4	43	69	599	97.3	96.8	95.5	0.896

In the early years, before the Puregene protocol and method of conducting PCRs and running gels in triplicate was refined, the percentage of samples that met the critical loci combination was low (35%, 52% and 62% for 1995, 1996 and 1997, respectively). For the three later years, over 80% of samples met the critical loci criteria and were used in further analyses.

Comparisons between MSA and WHICHRUN. We currently use two population genetic methods to distinguish among chinook runs: mixed stock analysis (MSA), a population-based technique, and individual assignment (WHICHRUN). The two methods are discussed in more detail elsewhere (Banks & Eichert 2000; Hedgecock et al. 2001, p52-54).

Here we compare them using data from 1998 winter carcasses, chosen because this sample consists of 511 fish (compared with between 39 and 124 from other years available at the time of analysis, see Table 1) and MSA has a minimum sample size requirement. We examine the winter / non-winter carcasses collected by month to determine whether there was any pattern in the frequency of returns by run. While MSA cannot assign individual fish to population of origin it has the capability of assigning proportions of a mixed stock to specific run, whereas WHICHRUN only has power to determine whether individual fish are winter or non winter. However, MSA requires a minimum sample size of approximately 100, so the August sample consisting of only 28 fish has a large standard error and cannot be interpreted with a high degree of confidence. In the WHICHRUN analysis, LOD-score thresholds of 0, 1 and 2 (representing increasing stringency) were compared. We selected winter (critical population) vs. "average likelihood of all other populations" in the denominator i.e., the least conservative method of assigning winter, since our ultimate aim was to provide an inclusive estimate of the number of winter-run returns.

Both MSA and WHICHRUN showed similar trends (Table 2a & b). As expected, more non-winter fish occurred in the tail ends of the collection i.e., May and August (Table 2b). This is especially evident in the WHICHRUN results. However, in 1998 the carcass collection did not appear to span the entire winter return period, since high proportions of winter run still occurred in both May and August (WHICHRUN: LOD>1 = 82.7% and 78.3%, respectively). In general, MSA gave the most stringent results and the proportions assigned to winter run were closest to the most stringent WHICHRUN criterion of LOD>2. It is likely that using the most conservative, "exclusive" approach (estimating the probability of winter run against the next most likely run), would give results closer to those from MSA.

We used these results to devise a strategy of subsampling the 2000 carcasses, which numbered some 1700 individuals. We recommended that all May and August fish be genotyped, together with a random subsample of fish collected in June and July (giving a grand total of N=718), since the chance of detecting a non-winter fish was considerably

Table 2. Comparison of Mixed Stock Analysis (MSA) and WHICHRUN methods in assigning winter run in 1998 carcass samples (all analyses used 7 loci).

a) Run analysis of fish collected by month

		MSA (proportion of sample assigned to each pop)					WHICHRUN		
							LOD>0	LOD>1**	LOD>2
Date	N	Winter	Sp-B	Sp-D/M	Fall	Late Fall	% Winter		
May	88	0.837	0.000	0.022	0.105	0.036	87.50	85.23	85.23
June	212	0.920	0.010	0.032	0.038	0.000	98.58	98.11	93.87
July	183	0.959	0.002	0.025	0.014	0.000	98.36	97.27	92.35
Aug	28	0.926*	0*	0.000*	0.006*	0.068*	92.86	82.14	82.14
Total	511	0.921	0.002	0.028	0.046	0.003	492	484	466
S. E.		0.013	0.000	0.002	0.005	0.001			

b) Summary of percent non-winter fish collected by month

Date	N	MSA	WHICHRUN		
			LOD<0	LOD<1	LOD<2
May	88	16.270	14.286	17.333	17.330
June	212	8.050	1.435	1.923	6.130
July	183	4.070	1.667	2.809	7.650
Aug	28	7.40*	7.692	21.739	21.740
Total	511	7.910	3.862	5.579	8.800

*Note: small N, high S. E., low confidence
**standard procedure to assign winter with 7 loci: LOD >1

higher in the flanking months than in the central ones. Table 3 summarizes the MSA results of the 2000 carcass samples analyzed by month. Since the comparison between all samples vs. those with the critical loci combination gives essentially identical results, MSA output for all samples is given only. Interestingly there is very little variation in the proportions of the four non-winter populations seen throughout the May to August collection period: spring-Butte Creek comprises between 2-2.5% of the sample each month, spring-Deer & Mill Creeks comprise approximately 2.5%, fall between 2.5-4% and late-fall around 2%. As with the 1998 carcasses there is no indication of winter-run being less abundant in the tail ends of the sample, again suggesting that the winter-run return period is longer than the four months currently being surveyed.

Table 3. Mixed stock analysis of the 2000 carcass sample.

		Proportion of sample				
Month	N	Winter	Sp-Butte	Sp-Deer / Mill	Fall	Late Fall
May	260	0.906	0.019	0.025	0.029	0.021
June	224	0.888	0.024	0.027	0.039	0.023
July / August	184	0.908	0.024	0.025	0.025	0.019
Total	668	0.900	0.022	0.026	0.031	0.021
S.E. (total)		0.013	0.001	0.001	0.002	0.001

<u>Analysis of outmigrating juveniles</u>**.** Samples of outmigrating juveniles collected as mortalities from screw traps located at the Red Bluff Diversion Dam (RBDD), together with some beach seine net samples, were analyzed over six years (1995-2000). For the first four years we received samples considered the winter-run size class (July to December). In 1999 and 2000 we received samples collected over the entire year. DNA was extracted using chelex and genotyped at up to 10 loci (Table 4).

Table 4. Summary of juvenile collection details and data analyses, 1995-2000. Individuals used in the MSA and WHICHRUN analyses were taken from the July-December collection period.

Year	samples received	Steel-head	col. Jan-Jun	col. Jul-Dec	no PCR amp	# used in MSA	# loci	# used in WHICHRUN	% Winter (LOD>1)
1995	114	0	1	113	0	113	10	103	98.06
1996	100	0	14	86	0	86	9	68	88.24
1997	379	1	0	378	50	328	7	312	97.12
1998	387	0	0	387	6	381	7	356	95.51
1999	657	0	103	554	13	541	7	502	96.22
2000	231	2	121	108	2	106	7	105	98.10

As before, individuals with insufficient data (see section 3 above) were excluded from the analysis. With the exception of two of the six years, over 90% of the juvenile samples passed the critical loci combination, and even in 1996 and 1997 approximately 80% of the samples were used in the analysis. The frequency of winter and non-winter individuals was plotted for 1995-97 (Figure 1) and 1998-2000 (Figure 2) by grouping their collection times into two week intervals (i.e., 1-15th and 16-31st of each month). In most cases, winter run were indeed primarily found in the latter half of the year, although there were some notable exceptions: in late February and early March of 1999, as well as in January of 2000, there were considerable numbers of outmigrating winter-run juveniles (Figure 2). For a complete list of all juveniles analyzed, their LOD score and run assignment (where applicable), see Appendix B.

Figure 1. Number of outmigrating winter and non-winter juvenile chinook salmo
(determined using WHICHRUN analysis) trapped at the Red Bluff Diversion Dam
Sacramento River from 1995-1997. An * indicates no sample received for that mont

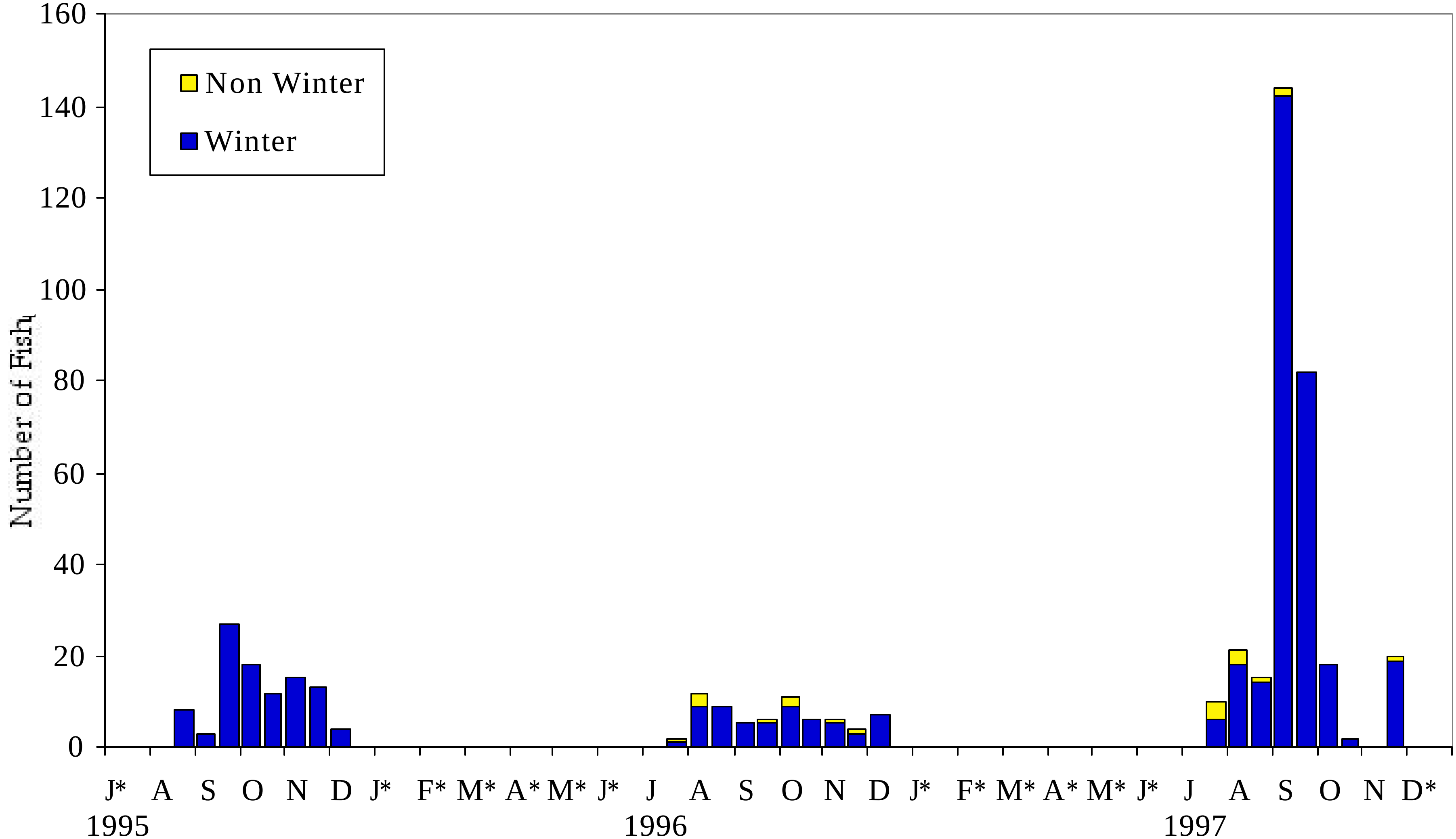
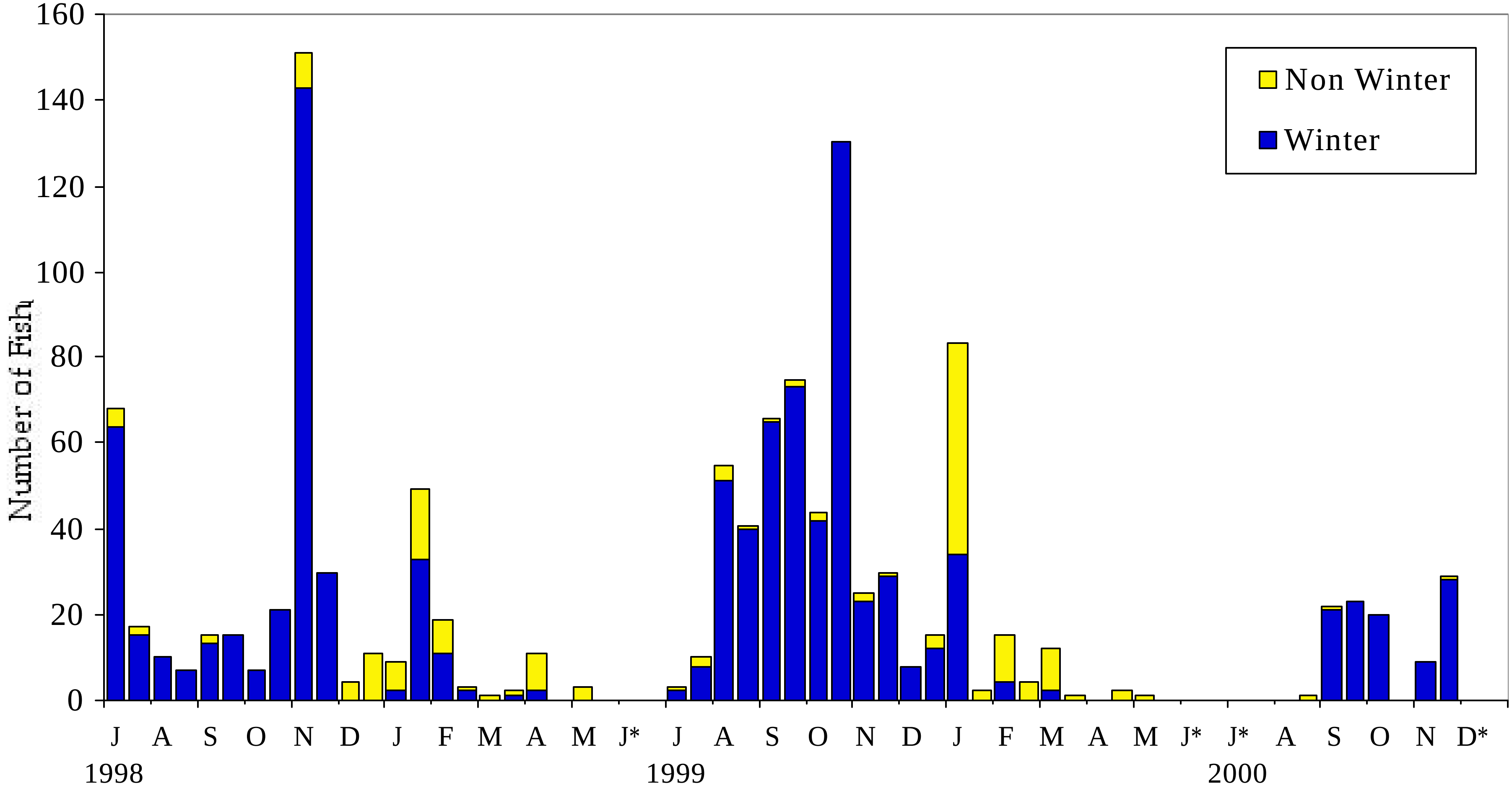


Figure 2. Number of outmigrating winter and non-winter juvenile chinook salmo: (determined using WHICHRUN analysis) trapped at the Red Bluff Diversion Dam Sacramento River from 1998-2000. An * indicates no sample received for that mont



Mixed stock analysis was used to analyze further the non-winter component of the outmigrating juveniles at RBDD. Figure 3 illustrates the breakdown of each annual sample (1995-2000) by population. Table 5 shows the proportions obtained for each population using a) samples with one or more loci (including those lacking the critical loci combination), b) individuals trapped during the first half of the winter-run outmigration period (July-September), c) individuals trapped during the second half of the winter-run outmigration period (October-December), and d) individuals with the critical loci combination required for WHICHRUN (as a comparison between the two methods). The proportion of samples comprising other runs is extremely low in all years, since winter-run abundance ranges from a low of 79.7% in 1996 to a maximum of 96.7% in 1997. In most cases there are no distinct patterns in the distribution of non-winter runs, either within or between years. There is essentially no difference in the proportion assigned to run using a) all individuals and d) those individuals with sufficient genotype data for WHICHRUN analysis (suggesting that individuals which did not pass the critical loci combination criteria were randomly distributed across all runs). Attempts to quantify the occurrence of other populations at the beginning and end of the winter-run outmigration period, i.e., b) and c), show little evidence of a pattern in the timing of non-winter run. Spring-Deer / Mill and fall run are consistently present in both halves of the collection period, while spring-Butte and late-fall are more sporadic, exhibiting all combinations of presence / absence, depending on the year. The one notable exception is the inclusion of appreciable numbers of late-fall fish (3.2% of the sample) at the beginning of the 1996 collection period, since late fall is rarely encountered at other times.

Figure 3. Number of outmigrating juvenile chinook salmon trapped at the Red Blu Diversion Dam, Sacramento River from 1995-2000 (July-December). Populations determined using mixed stock analysis (MSA).

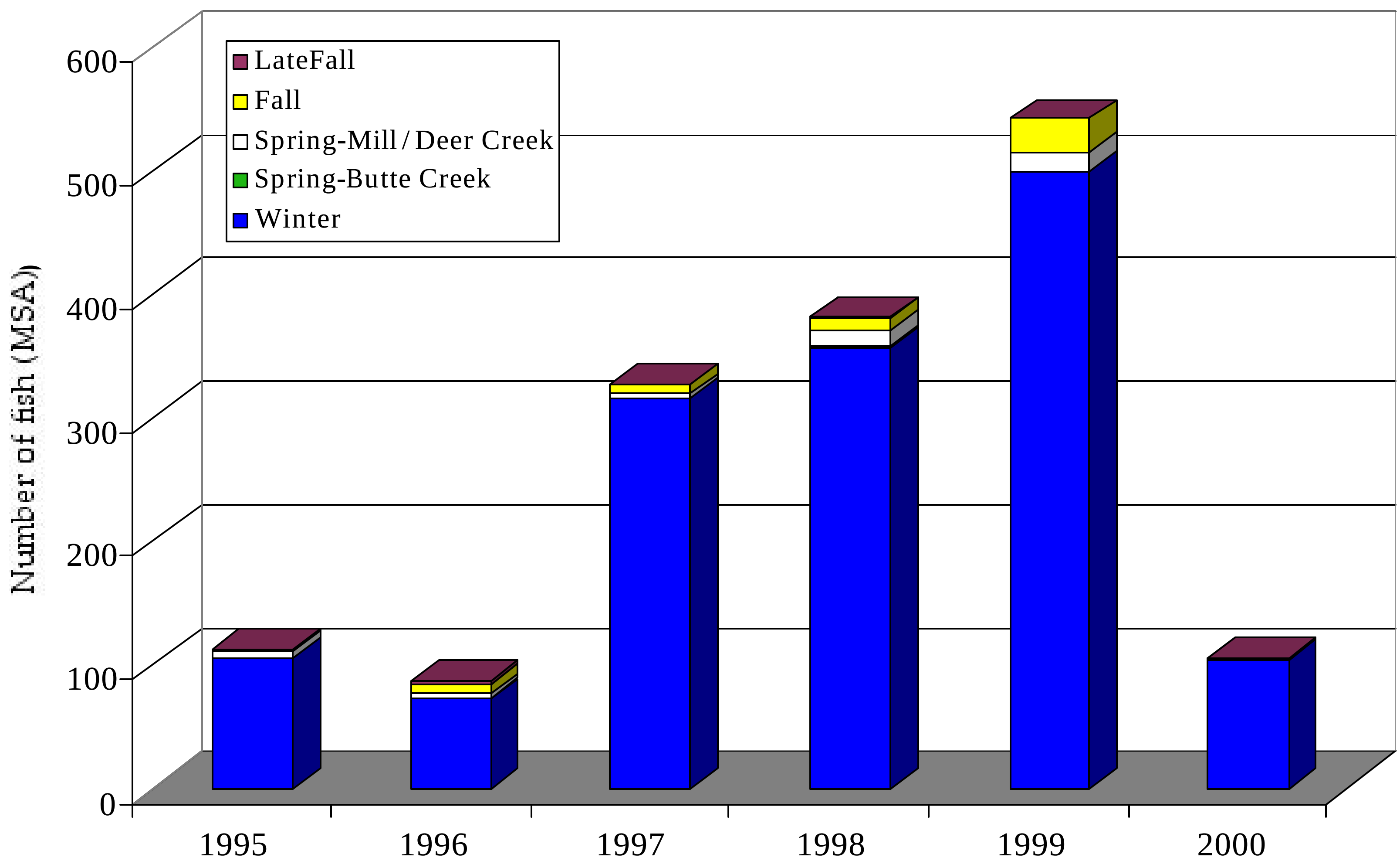


Table 5. Summary of MSA analysis of RBDD juveniles (1995-2000) giving the proportion of sample assigned to each population using a) samples with one or more loci, b) samples collected in the first half of the winter-run outmigration period, c) samples collected in the second half of the outmigration period, and d) samples with the critical loci combination required for WHICHRUN.

	a) >1locus			b) Jul-Sept			c) Oct-Dec			D) Critical loci combination		
Winter												
	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.
1995	113	0.928	0.025	42	0.903	0.047	71	0.941	0.027	103	0.922	0.027
1996	86	0.840	0.043	38	0.797	0.067	48	0.876	0.056	68	0.863	0.047
1997	328	0.965	0.011	286	0.967	0.011	42	0.952	0.033	312	0.963	0.011
1998	381	0.931	0.013	133	0.930	0.024	248	0.933	0.016	356	0.927	0.014
1999	541	0.920	0.012	255	0.910	0.018	286	0.929	0.015	502	0.923	0.012
2000	106	0.971	0.017	66	0.954	0.027	40	0.996	0.001	105	0.971	0.017
Sp-Butte												
	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.
1995	113	0.000	0.000	42	0.000	0.000	71	0.000	0.000	103	0.000	0.000
1996	86	0.006	0.001	38	0.014	0.002	48	0.000	0.000	68	0.005	0.001
1997	328	0.001	0.000	286	0.001	0.000	42	0.000	0.000	312	0.001	0.000
1998	381	0.007	0.001	133	0.000	0.000	248	0.013	0.001	356	0.008	0.001
1999	541	0.002	0.000	255	0.003	0.000	286	0.001	0.000	502	0.002	0.000
2000	106	0.000	0.000	66	0.000	0.000	40	0.001	0.000	105	0.000	0.000
Sp-Deer / Mill												
	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.
1995	113	0.060	0.008	42	0.061	0.014	71	0.058	0.007	103	0.064	0.009
1996	86	0.039	0.009	38	0.025	0.005	48	0.073	0.030	68	0.029	0.004
1997	328	0.007	0.001	286	0.010	0.001	42	0.000	0.000	312	0.007	0.001
1998	381	0.034	0.003	133	0.034	0.003	248	0.034	0.005	356	0.036	0.004
1999	541	0.027	0.002	255	0.042	0.005	286	0.012	0.002	502	0.027	0.002
2000	106	0.009	0.001	66	0.014	0.002	40	0.001	0.000	105	0.009	0.001

Fall

	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.
1995	113	0.013	0.003	42	0.036	0.013	71	0.000	0.000	103	0.014	0.003
1996	86	0.101	0.019	38	0.132	0.030	48	0.050	0.018	68	0.091	0.016
1997	328	0.027	0.002	286	0.021	0.001	42	0.048	0.007	312	0.029	0.002
1998	381	0.026	0.002	133	0.031	0.003	248	0.021	0.001	356	0.028	0.002
1999	541	0.050	0.005	255	0.046	0.008	286	0.055	0.007	502	0.048	0.005
2000	106	0.020	0.002	66	0.032	0.004	40	0.001	0.000	105	0.020	0.002

Late Fall

	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.	N	Pr.	S.E.
1995	113	0.000	0.000	42	0.000	0.000	71	0.000	0.000	103	0.000	0.000
1996	86	0.015	0.020	38	0.032	0.037	48	0.000	0.000	68	0.013	0.018
1997	328	0.001	0.000	286	0.001	0.000	42	0.000	0.000	312	0.001	0.000
1998	381	0.000	0.001	133	0.005	0.008	248	0.000	0.000	356	0.001	0.002
1999	541	0.000	0.001	255	0.000	0.000	286	0.002	0.003	502	0.000	0.000
2000	106	0.000	0.000	66	0.000	0.000	40	0.002	0.000	105	0.000	0.000

4. Sacramento River and Battle Creek Trapping

Rapid response program. The winter-run chinook salmon propagation program (initiated in 1989), and the captive broodstock program (initiated in 1991) are recognized in the NMFS's draft Recovery Plan for this endangered species. In 1996, the USFWS initiated a two-year, self-imposed moratorium on the collection of naturally spawning adults from the Sacramento River. This was done in light of evidence that winter- and spring-runs had been hybridized in three of the first five years of the captive broodstock program (1991, 1993 and 1995) (Hedrick et al. 2000a; Hedgecock et al. 2001; Hedgecock et al. in prep). In addition, individuals propagated at Coleman National Fish Hatchery (CNFH) in the early days of the program were found to have imprinted on Battle Creek instead of the main stem of the Sacramento River.

We devised a real-time, “rapid response” protocol to genotype and identify to run all salmon returning between February and July (the program was initiated in 1997 in Battle Creek, but is included here for completeness). Fish were trapped, numbered and fin clipped and the tissue FedExed to BML overnight. Immediately upon arrival, DNA was extracted from each tissue sample in triplicate (chelex technique) and amplified (PCR) at the core five dinucleotide loci. Using WHICHRUN, each fish was classed as winter or non-winter run based on its LOD score, using the more conservative “next most likely” selection in the denominator to minimize type II error. If the LOD score was less than two, but greater than zero, the fish was genotyped at the two tetranucleotide loci (*Ots-104* and *-107*) and the LOD score again determined, the new threshold for winter run being LOD >1.

Fish traps were placed in Battle Creek to capture returning spawners reared at CNFH. In 1997 we handled a total of 116 fish in “rapid response” mode. Any winter-run fish (of hatchery origin) were relocated to the Sacramento River. In 1998, when the moratorium on capture of naturally spawning winter run was lifted, individuals for the broodstock program were also trapped at Keswick Dam on the Sacramento River. In 1998, 1999 and 2000 we genotyped a total of 268, 112 and 216 fish from both sites, respectively. In 2001, 238 fish from the Sacramento River were genotyped and trapping at Battle Creek was terminated, since returns from the last CNFH-reared broodyear (1995), at five years of age, were not anticipated. Table 6 gives the numbers of fish caught at each trapping site and the numbers determined to be winter run, using molecular genetic techniques. Winter-run individuals caught at Keswick were transported to Livingston Stone National Fish Hatchery for artificial propagation. Appendix C gives details of all fish handled from 1997-2001 as part of the rapid response program in Battle Creek and the Sacramento River.

We note that trapping for broodstock in the Sacramento River ended in May (1998), early June (1999) or early July (2000 and 2001). Analysis of carcass collections show that high numbers of winter run continue to be collected in July and August (Tables 2 and 3). As we cannot be certain that we are randomly sampling for broodstock over the entire winter-run return period, the hatchery program could potentially be exerting selection on run timing.

Table 6. Summary of "rapid response" winter-run assessment, 1997-2001.

YEAR	SACRAMENTO RIVER		BATTLE CREEK	
	# Genotyped	# Winter	# Genotyped	# Winter
1997	n / a	n / a	116	89
1998	152	107	117	15
1999	42	24	70	0
2000	162*	109	54**	4
2001	238	209	n / a	n / a

* 163 received, 1 no call
** 55 received, 1 no call

5. Estimation of Effective Population Size (N_e)

Verification of the effective population size model**.** Through genotyping returning spawners and carcasses collected from Battle Creek and the Sacramento River we were able to assign hatchery-bred fish to broodstock family of origin. Using seven loci, the parentage of returning fish was unambiguously assigned for two fish spawned in 1993, 93 fish spawned in 1994 and 23 fish spawned in 1995. These data were used to calculate the observed effective population size for 1994 and 1995 and verify the predictions of the model (Hedrick et al. 2000a, 2000b). We found no evidence of selection, as survival across families was near random. For example, in the 1994 broodstock, each male (n=10) and female (n=16) parent was represented in the 93 assignable returning spawners, and the ratio of the proportions that were released to the proportions that returned from each individual ranged from 0.38 to 1.64. The earlier predictions based on random returns were indeed confirmed by empirical data, and the calculated effective population sizes in 1994 and 1995 were within the ranges predicted by the model (Table 7), (Hedrick et al. 2000b).

Table 7. The predicted and observed effective population sizes for 1994 and 1995. Values in parentheses are 95% confidence intervals (Hedrick et al. 2000b).

Year	N_e estimate*	Predicted	Observed
1994	$N_{e(v)}$	34.8 (28.1, 41.2)	31.5
	$N_{e(i)}$	32.7 (26.5, 38.9)	30.2
1995	$N_{e(v)}$	24.5 (16.1, 34.3)	18
	$N_{e(i)}$	23.2 (14.8, 33.0)	18.3

*$N_{e(v)}$ and $N_{e(i)}$ are the variance and inbreeding effective population sizes, respectively.

Estimating effective population size of winter-run chinook salmon from juvenile and carcass samples. We presented our findings as a poster at the 2001 Coastwide Salmonid Genetics Meeting (October 25-28). A reproduction of the poster is attached (see Appendix D), and excerpts from the text, together with tables, are provided below.

Abstract. Variance effective population size (N_e) of endangered winter-run chinook salmon in the Sacramento River, California was estimated using polymorphic microsatellite loci. F-statistic and maximum likelihood methods were applied to paired temporal samples of adults for three broodlines (1995/98, 1996/99, 1997/00). The linkage disequilibrium (LD) method was used to analyze samples from six years of outmigrating juveniles (1995-2000). Most estimates were undefined, which suggests insufficient power to estimate N_e confidently with available samples given run sizes (N) ranging from 841 to 3208. When alleles were pooled, defined point estimates of N_e were obtained in many cases. For the temporal variance (TV) methods, radical pooling (two pools) gave lower estimates of N_e than mild pooling for all three broodlines. Radical pooling was also more likely to give a finite upper N_e bound (95% confidence interval). The LD method with radical pooling gave point estimates of N_e for four of the six years, although finite upper bounds were never obtained. Both approaches produced estimates of N_e that fluctuate in accordance with variation in census size for the three broodlines and are not inconsistent with the N_e / N ratios of 0.1 and 0.33 proposed by Bartley et al. (1992) and Waples (in press), respectively.

Introduction. Effective population size (N_e) is an important parameter in the evolutionary dynamics of genes. It determines rate of loss of genetic variation through genetic drift, which in turn defines population adaptive potential. Small effective size results in an increased rate of inbreeding and fixation of deleterious alleles, thereby increasing the probability of extinction. Given Sacramento River winter-run chinook's extreme population reduction and subsequent artificial supplementation, estimates of N_e can provide useful information to fisheries managers over time. N_e can be estimated from changes in allele frequencies over generations or from non-random associations between pairs of loci in a single generation. Since salmon predominantly spawn at age three (Table 8), (Hedrick et al. 2000b), the population is segregated into three, partially reproductively isolated, broodlines. Therefore, in this study, we estimate N_e for each broodline separately. Overall N_e for the winter run chinook population would be approximately equal to three times the harmonic mean of the three N_e values (Waples, in press):

$$\frac{1}{N_e} = \left(\frac{1}{N_{e(1)}} + \frac{1}{N_{e(2)}} + \frac{1}{N_{e(3)}}\right) / 3$$

Table 8. Sex and age at return for hatchery-origin Sacramento River winter-run chinook salmon (Hedrick et al. 2000b).

	Age at return (years)			
Sex	2	3	4	Total
Male	12	27	6	45
Female	0	65	2	67
Unknown	1	16	0	17
Total	13	108	8	129*

* Total includes 118 fish assigned to a family by genetic markers or coded-wire tags, plus 11 fish assigned to two families by genetics, but with both families belonging to the same year class, making their age, at least, unambiguous.

Materials and Methods

Temporal Variance Method (TV)

The standardized variance of change in allele frequency (*F*) is often used to estimate N_e from temporal samples (Nei and Tajima 1981; Pollack 1983; Waples 1988). The harmonic mean of the samples can be used to correct for sampling error. Returning spawners and spawned carcasses collected in the upper Sacramento River from 1995-2000 were genotyped at seven microsatellite loci. Since the majority of chinook salmon spawn at three years of age (Table 8), (Hedrick et al. 2000b), six years of data comprise three broodlines, each sampled one generation apart. Allele frequencies were calculated and either left unpooled or pooled in one of two ways 1) mild pooling: combined alleles with < 10% frequency until a total frequency of 10% was achieved, leaving all other alleles unpooled, 2) Radical pooling: two pools only, the most abundant allele in the first and the remainder in the second. The *F*-statistic and N_e were estimated using equations for sampling plan I (Waples 1989), where individuals are taken after reproduction.

Maximum Likelihood Methods

In Williamson and Slatkin's maximum-likelihood (ML) method (1999), the probabilities of a population changing from one set of allele frequencies to another constitute a transition matrix. A transition from the parental allelic frequencies to the offspring is conditional on parameter *N*, a quantity related to N_e when a population evolves according to the Wright-Fisher model. The ML estimate of N_e is based on the value of *N*, which results in a transition with the best fit to the empirical data. This ML estimator has a lower variance and smaller bias than the *F*-statistic estimator, but insufficient power to compute likelihood estimates from large transition matrices restricted application to the case of two alleles at a locus. The latter problem has been solved with Monte Carlo simulation technique using importance sampling (Anderson et al. 2000) and with a pseudo-likelihood method using hidden Markov chain algorithm. Maximum likelihood methods are considered superior to *F*-statistic because nuances of allele frequency changes are considered and therefore variance and bias is lowered. Monte Carlo maximum likelihood calculations and simulations were executed using the software McLeeps (http://www.stat.washington.edu) and pseudo-likelihood software (Wang, submitted).

Linkage Disequilibrium Method (LD)

Linkage disequilibrium is the nonrandom association of alleles at different gene loci. For neutral genes or sites, the disequilibrium (*D*) can be used to estimate population size because the correlation of gene frequencies (*r*) is a known function of population size (Hill 1981; Waples 1991). Outmigrating juveniles collected at the Red Bluff Diversion Dam from 1995-2000 were genotyped at ten (1995), nine (1996) or seven (1997-2000) microsatellite loci. Values for *r* were calculated in two ways using the software Genetix (http://www.univmontp2.fr/~genetix/genetix.htm). The data were either left unpooled or separated into two pools: the most abundant allele vs. all other alleles.

Pooling Data

Using the TV and LD methods, N_e becomes defined when F or r^2, respectively, are greater than the sampling error. Pooling decreases sampling error by grouping together rarer alleles while maintaining the signal from the parameter. Rare alleles increase error when they are unique to one sample in a set of related samples or if their allele frequencies are highly variable.

Results. Our N_e estimates using the TV methods for three broodlines of winter-run chinook salmon resulted in both defined and undefined values, depending upon whether alleles were pooled (Table 9). N_e for two out of three broodlines produced finite upper and lower bounds after radical pooling. Estimates of N_e using the LD method and radically pooled data produced defined point estimates of N_e for four out of the six years, while one was obtained using unpooled data (Table 10). All estimates had finite lower bounds and infinite upper bounds.

Discussion. We were unable to confidently estimate N_e for winter-run chinook salmon using the TV and LD methods and suggest that to accomplish this, sample size must be close to actual N_e. Table 11 shows the range of N_e estimates based on the N_e / N ratio proposed by Bartley et al. (1992) and Waples (in press), which are up to 2-3 times larger than our sample sizes. Most N_e point estimates produced by the TV and LD methods fell in and around the proposed ranges, but frequently the upper bounds of confidence intervals reached infinity. Pooling data resulted in greater N_e estimate precision but at the expense of accuracy. As data were pooled TV methods produced more defined, but lower, point estimates. Similarly, without pooling data the LD method resulted in a defined point estimate for 1996 only, which was lower than the results using unpooled data. The TV method was more successful than the LD method in that it produced finite confidence intervals after radical pooling. This is not surprising as detection of linkage disequilibrium is known to be sensitive to sample size and number of loci used (Hill 1981; Waples 1991). Though *F* is also affected by sample size and number of loci used, it is not constrained in ways that *D* is. LD methods are useful because they can be used on more readily available independent data. Surprisingly the performances of the *F*-statistic and maximum likelihood approaches are not strikingly different (see Table 9). Though ranges rather than point estimates were obtained using the Monte Carlo method, they were defined only after mild pooling. The only indication that one method out-performed the others is the defined N_e estimate for Broodline I resulting from the pseudo-likelihood method without pooling data.

Our estimates of effective population size for each broodline will be improved, both in terms of precision and accuracy, by additional years of samples. Adult returns for 2001, 2002 and 2003 will allow two generations per broodline to be analyzed instead of only one. In addition, if larger sample sizes closer to the census size are obtained, the likelihood of finite upper confidence intervals of N_e for both TV and LD methods would increase. We should point out that the nature of the project makes it extremely difficult to obtain accurate estimates, for example, the number of winter-run carcasses collected by the USFWS in 2000 (approximately 1700) exceeds the official census size estimate of 1350.

Table 9. N_e estimates for three broodlines of adult winter chinook salmon using temporal variance methods.

Pooling	Broodline I 1995 (N=74) 1998 (N=627) *Sample Size: 61.9				Broodline II 1996 (N=35) 1999 (N=266) *Sample Size: 132.4				Broodline III 1997 (N=117) 2000 (N=671) *Sample Size: 199.3			
	df**	F_k	N_e	95% CI	df**	F_k	N_e	95% CI	df**	F_k	N_e	95% CI
F-Statistic:												
Without	63	0.008		138-	52	0.019		60-	62	0.007		203-
Mild	30	0.011	202	45-	20	0.030	54	12-	26	0.009	277	52-
Radical	7	0.022	36	6-329	7	0.044	20	3-809	7	0.011	112	13-
Monte Carlo:												
Without												
Mild			190-220				65-90				500-600	
Radical			30-50				20-25				130-155	
Pseudo-L:												
Without			648									
Mild			112				41	13-			250	54-
Radical			33	775			11	6-1163			128	16-

*harmonic mean of sample sizes (numbers of fish) in broodline

**degrees of freedom: number of independent alleles

Table 10. N_e estimates for six years of juvenile winter chinook salmon using the linkage disequilibrium method.

Year	# of loci	# of fish	Harmonic mean sample size (S)*	Pooling	N_e	95% CI
1995	10	101	74.11	without		49.2 –
				radical	273.3	19.4 –
1996	9	60	39.00	without	214.6	10.7 –
				radical	354.7	11.2 –
1997	7	303	278.64	without		216.7 –
				radical		126.2 –
1998	7	340	305.92	without		233.7 –
				radical	237.0	51.4 –
1999	7	483	429.91	without		792.5 –
				radical	218.0	58.4 –
2000	7	103	95.82	without		34.0 –
				radical		51.3 –

*harmonic mean of the number of individuals scored for each pairwise combination of loci

Table 11. Estimated N_e ranges of winter-run chinook based on census size.

TV method	LD Method		
Broodline*	Year	Census Size (N)**	Range of Ne (0.1 - 0.33N)***
I (1995-1998)	1995	1361	136.1 - 449.1
II (1996-1999)	1996	940	94.0 - 310.2
III (1997-2000)	1997	841	84.1 - 277.5
	1998	2612	261.2 - 861.9
	1999	3208	320.8 - 1058.6
	2000	1350	135.0 - 445.5

* Census size based on the first year for each broodline
** Census size estimates according to USFWS
*** Range estimates of Ne (Bartley et al. 1992; Waples, in press)

6. Effect of Releases from the Captive Broodstock: the Tripartite Model

Introduction. Populations of endangered species are often small and, as a result, loss of genetic variation and fixation of detrimental variation from genetic drift are of great concern (Hedrick 2000). In addition, the supplementation of wild populations of endangered species by hatchery-reared individuals may result in a further reduction of population size (Ryman and Laikre 1991). As a result, Hedrick et al. (1995; 2000b) developed an approach to estimate the effect of supplementation on the population size of the natural run of the endangered winter-run chinook salmon. In their evaluation of the 1991 to 1995 releases, it appeared that the supplementation program did not greatly affect, either positively or negatively, the overall effective population size. The apparent responsible factors were that the protocol developed to even out the contributions of individual males and females increased the effective size of the captive releases and the proportion of contribution from the captive-reared individuals was not too high. In addition, an evaluation of the effective population size of the returning spawners from the 1994 and 1995 releases showed that the returns were not different from that expected at random (Hedrick et al. 2000a), confirming the predictions made from the releases for those years (Hedrick et al. 2000b).

In addition, individuals have been released from the captive broodstock program at Bodega Marine Laboratory (BML). These releases may influence the effective population size of the wild population in two general ways. First, the progeny of the spawners raised at BML may have a low effective population size when they are released because of unequal representations of families in the extra generation in captivity. Second, the contribution of some families used for supplementation may be larger than originally conceived because added grandprogeny from these individuals have been produced and released from the broodstock program.

Below, the potential effects of both these factors are examined to provide a context to evaluate the potential impact of use of the broodstock on the wild effective population size. To completely model the impact of broodstock contribution is complicated and entails understanding the effects of using contributions from the same individuals, or their progeny, in two different generations. As a result, an approach was used here that considers a relatively large effect for each of these potential factors separately.

Methods. Ryman and Laikre (1991) developed a model that incorporates the joint effects of finite population size of both the wild run and hatchery-reared individuals on the overall effective population size. Their formulation can be written as

$$N_e = \frac{N_{ew}N_{eh}}{x_w^2 N_{eh} + x_h^2 N_{ew}}$$

where N_{ew} and N_{eh} are the effective sizes of the wild and hatchery populations and x_w and x_h are proportional contributions of the wild and hatchery runs to the progeny ($x_w + x_h = 1$).

This model can be expanded to include the broodstock if we assume that the effective size and the contribution of the broodstock are N_{eb} and x_b so that the overall effective population size then becomes

$$N_e = \frac{N_{ew}N_{eh}N_{eb}}{x_w^2 N_{eh}N_{eb} + x_h^2 N_{ew}N_{eb} + x_b^2 N_{ew}N_{eh}}$$

Notice if $x_b = 0$, then this expression becomes equal to the one given above.

Results

Effect of Broodstock Effective Population Size

To illustrate the potential effect of adding the broodstock as a source for releases, let us explore a numerical example that is similar to the situation to that encountered in recent years. First, let us assume that the effective population size for the wild population, N_{ew}, is approximately 350 and that the effective population size for the hatchery population, N_{eh}, is approximately 100 (the precise values used here do not make significant differences in the results).

Now let us assume that the contribution from the broodstock is lower than that from the hatchery so that $x_w = 0.7$, $x_h = 0.2$, and $x_b = 0.1$. Line (a) of Table 12 gives the expected effective population size for these contributions when the effective population size from the broodstock is 50. In this case, the release proportions are in the same ratios as the effective population size for the three sources so that the overall effective population size is 500, equal to the sum of the individual effective sizes.

Table 12. The overall effective population size when $x_w = 0.7$, $x_h = 0.2$, and $x_b = 0.1$ and the effective population size of the broodstock, N_{eb} is 50, 25 or 5.

	N_{ew}	N_{eh}	N_{eb}	N_e
(a)	350	100	50	500
(b)	350	100	25	454
(c)	350	100	5	263

The concern for using the broodstock can be encapsulated most easily by realizing that a generation in captivity for the broodstock may reduce the effective population size of the progeny released. As an example of this, let us assume that the effective population size is reduced by half to 25 and that the proportional releases from different sources are the same. In this case the overall effective population size is given in line (b) of Table 12 and is 454, a reduction of 9.2%. Finally, let us assume that there is a large reduction in the effective size of the broodstock so that N_{eb} = 5. In this case, as given on line (c) of Table 12, the effective size is only 263, a rather large reduction of 47.4% in the overall effective population size.

Effect on Contribution from Hatchery

The overall effective population may also be reduced because the spawners that were used to produce progeny for supplementation also were used to produce progeny for the broodstock. An easy way to understand this effect is to assume that it is similar to increasing the value on x_h over that originally used when fish were released from the hatchery. To illustrate this effect, let us assume that N_{ew} = 400 and N_{eh} = 100. As given under (a) in Table 13, if x_h = 0.2, then the overall N_e = 500, as expected. However, if the value of x_h is increased because fish descended from the same spawners as used in the supplementation program were used, then the overall effective population size is decreased. For example, if x_h is increased to 0.3 or 0.5 then the overall effective population size is reduced to 471 and 320, declines of 5.8% and 36%, respectively.

Table 13. The overall effective population size when N_{ew} = 400 and N_{eh} = 100 and x_h is 0.2, 0.3, or 0.4.

	x_w	x_h	N_e
(a)	0.8	0.2	500
(b)	0.7	0.3	471
(c)	0.5	0.5	320

Discussion. Two genetic impacts of releasing fish descended from the captive broodstock have been considered, the reduction of effective size in the broodstock fish and the increased representation of spawners used for supplemenation. First, if the effective population size from the broodstock is in the same ratio to the other two sources as their contributions, then the effective size is not reduced. However, if the effective size is reduced because of the extra generation in captivity and the contribution remains the same, the overall effective population size may be reduced. A straightforward approach to mitigate this effect is to reduce the contribution from the broodstock to equal (or less than) the ratio of the broodstock effective size to the total effective population size for the three sources. In other words, x_b could be equal to or less than $N_{eb} / (N_{ew} + N_{eh} + N_{eb})$.

Second, if the contribution from spawners used for supplementation is increased because of the use of their progeny in the broodstock program, then the overall effective population may be reduced. However, in the numerical example given above when the contribution is increased by 50%, then the effective population size is reduced by only 5.8%. One way to potentially circumvent this effect would be to not release a number of progeny large enough to greatly increase the contribution from the hatchery. An indirect approach would be to avoid releasing grandprogeny of original spawners from the broodstock if these families were overly represented in the original releases (or in natural returns if such data are available) from the supplementation program. Although this approach would not influence the hatchery contribution, it would potentially increase the effective population size of the releases from the hatchery.

Overall, use of the captive broodstock to produce progeny for release may have some negative genetic consequences in reducing the expected genetic variation in the natural population. However, if care is taken to ensure that the effective population size of the broodstock is as high as possible and that the hatchery contribution is not increased too much, then releases from the captive broodstock are not unreasonable. Of course, this should also be considered in the context of releasing individuals that may have undergone a generation of selection under captive conditions at BML, another genetic factor of potential significance but of even greater difficulty to evaluate.

7. Publications

Banks MA, MS Blouin, BA Baldwin, VK Rashbrook, HA Fitzgerald, SM Blankenship and D Hedgecock (1999). Isolation and Inheritance of Novel Microsatellites in Chinook Salmon (*Oncorhynchus tschawytscha*). *Journal of Heredity* 90: 281-288.

Banks MA, VK Rashbrook, MJ Calavetta, CA Dean and D Hedgecock (2000). Analysis of Microsatellite DNA resolves Genetic Structure and Diversity of Chinook Salmon (*Oncorhynchus tshawytscha*) in California's Central Valley. *Canadian Journal of Fisheries and Aquatic Sciences* 57: 915-927.

Banks MA and W Eichert (2000). WHICHRUN (version 3.2): A Computer Program for Population Assignment of Individuals based on Multilocus Genotype Data. *Journal of Heredity* 90: 281-288.

Garrigan D and PW Hedrick. Class I MHC Polymorphism and Evolution in Endangered California Chinook and other Pacific Salmon. *Immunogenetics* (in press).

Greig C and MA Banks (1999). Five Multiplexed Micosatellite Loci for Rapid Response Run Identification of California's Endangered Winter Chinook Salmon. *Animal Genetics* 30: 318-320.

Hedgecock D, MA Banks, VK Rashbrook, CA Dean and SM Blankenship (2001). Application of Population Genetics to Conservation of Chinook Salmon Diversity in the Central Valley. In: *Contributions to the Biology of Central Valley Salmonids, Fish Bulletin* 179: 45-70.

Hedgecock D and K Coykendall. Genetic risks of hatchery enhancement: the good, the bad, and the unknown. In: *Ecological and Genetic Implications of*

Aquaculture Activities, Bert TM (editor), Kluwer Academic, Netherlands (in press).

Hedrick PW, VK Rashbrook and D Hedgecock (2000a). Effective Population Size and N_e/N ratio: an Example from the Endangered Winter-Run Chinook Salmon. *Canadian Journal of Fisheries and Aquatic Science* 57 (12): 1268-2373.

Hedrick PW, D Hedgecock, S Hamelberg and SJ Croci (2000b). The Impact of Supplementation in Winter-Run Chinook Salmon on Effective Population Size. *Journal of Heredity* 9: 112-116.

Kim JT, JM Parker and PW Hedrick (1999). MHC Differentiation in Sacramento River Chinook Salmon. *Genetics* 151: 1115-1122.

8. Conference Presentations

Blankenship SM (2001). Microsatellites Reflect Evolution of Larger Units of Drift or Selection. Coastwide Salmonid Genetics Meeting, Bodega Marine Laboratory, 27 October 2001.

Churikov D, SJ Sabatino, VK Rashbrook and D Hedgecock (2001). Estimating Effective Population Size of Winter-Run Chinook Salmon. Poster presentation: Coastwide Salmonid Genetics Meeting, Bodega Marine Laboratory, 27 October 2001.

Hedgecock D (2001). Progress in Estimating Allele-frequencies in Samples of Juveniles. Coastwide Salmonid Genetics Meeting, Bodega Marine Laboratory, 27 October 2001.

Hedgecock D (2000). Genetic Diversity and Structure of Chinook Salmon Populations in the Central Valley of California. Invited speaker, CalFED Science Conference, 3 October 2000, Sacramento.

Hedgecock D (2000). Genetic Diversity and Structure of Chinook Salmon Populations in the Central Valley of California. Salmon Project Work Team, Interagency Ecological Program, Department of Water Resources, Sacramento, 30 October 2000.

Hedgecock D (1999). Population and Conservation Genetics of Central Valley Chinook Salmon. Sixth U.C., Division of Agriculture and Natural Resources, Continuing Conference on Salmonid biology, 9-10 March 1999, BML.

Hedgecock D (1999). Hybridization of Protected Chinook Salmon in California as a Consequence of Hatchery Supplementation. Coastwide Salmonid Genetics Meeting, 2-6 June 1999, University of Montana.

Hedgecock D (1999). Genetic Risks of Hatchery Enhancement: The Good, the Bad and the Unknown. Invited symposium speaker, American Fisheries Society annual meeting, 1 September 1999, Charlotte, N.C.

Hedgecock D (1999). Genetics of Central Valley Chinook Salmon. Invited presentation and comments to the Re-evaluation of Coleman National Fish Hatchery Operations, Red Bluff USFWS office, 9 September 1999.

Hedgecock D (1999). Genetic Identification of Central Valley Chinook Salmon. Invited speaker, Interagency Ecological Program Salmon workshop, 29 September 1999, BML.

Rashbrook VK (1999). Using Molecular Techniques to Preserve Genetic Integrity of Endangered Salmon in a Hatchery Supplementation Program. Poster presentation: Coastwide Salmonid Genetics Meeting, Missoula, June 1999.

Hedgecock D (1998). Genetics of Chinook salmon in the Central Valley. Invited presentation to CalFED, May 28, 1998, Sacramento.

Rashbrook VK, HA Fitzgerald, MA Banks and D Hedgecock (1998). Use of Population and Molecular Genetic Techniques to Manage an Endangered Population of Salmon in California. Poster presentation: African Fishes and Fisheries, Diversity and Utilization. Grahamstown, South Africa, September 1998.

9. References

Anderson EC, EG Williamson and EA Thompson (2000). Monte Carlo Evaluation of the Likelihood for N_e from Temporally Spaced Samples. *Genetics* **156**: 2109-2118.

Bartley D, M Bagley, G Gall and B Bentley (1992). Use of Linkage Disequilibrium Data to estimate Effective Size of Hatchery and Natural Fish Populations. *Conservation Biology* 6: 365-375.

Hedrick PW (2000. *Genetics of Populations* (Second Edition). Jones and Bartlett, Boston, MA, 553 p.

Hedrick PW, D Hedgecock and S Hamelberg (1995). Effective Population Size in Winter-Run Chinook Salmon. *Conservation Biology* 9: 615-624.

Hill WG (1981). Estimation of Effective Population Size from Data on Linkage Disequilibrium. *Genetics* 104: 531-548.

Nei M and F Tajima (1981). Genetic Drift and Estimation of Effective Population Size. *Genetics* 98: 625-640.

Nelson RJ and TD Beacham (1999). Isolation and Cross Species Amplification of Microsatellite Loci useful for Study of Pacific Salmon. *Animal Genetics* 30: 228-229.

Pollack E (1983). A New Method for Estimating the Effective Population Size from Allele Frequency Changes. *Genetics* 104: 531-548.

Ryman N and L Laikre (1991). Effects of supportive breeding on the genetically effective population size. *Conservation Biology* 5:325-329.

Scribner KT, JR Gust and RL Fields (1996). Isolation and Characterization of Novel Salmon Microsatellite Loci: Cross-Species Amplification and Population Genetic Applications. *Canadian Journal of Fisheries and Aquatic Sciences* 53:833-841.

Wang J. A Pseudo-Likelihood Method for Estimating Effective Population Size from Temporally Spaced Samples. *Genet Res. Camb.*, submitted.

Waples RS (1988). A Generalized Approach for Estimating Effective Population Size from Temporal Changes in Allele Frequency. *Genetics* 121: 379-391.

Waples RS (1991). Genetic Methods for Estimating the Effective Size of Cetacean Populations. *Rep. Int. Whal. Comn* (Special Issue 13) 279-300.

Waples RS. Definition and Estimation of Effective Population Size in the Conservation of Endangered Species. pp. 147-168 in: Beissinger, SR and DR McCullough, eds. *Population Viability Analysis*. University of Chicago Press, Chicago, IL. (in press).

Williamson EG and M Slatkin (1999). Using Maximum Likelihood to Estimate Population Size from Temporal Changes in Allele Frequencies. *Genetics* 152: 755-761.

10. Appendices

A. Carcass samples collected from the upper Sacramento River, 1995-2000

B. Juvenile samples collected at the Red Bluff Diversion Dam, 1995-2000

C. "Rapid Response" samples trapped at Battle Creek, Keswick Dam and Red Bluff Diversion Dam, 1997-2001

D. Poster: Estimating Effective Population Size of Winter-Run Chinook Salmon

Appendix A. Carcass samples collected from the upper Sacramento River, 1995-2000. Samples without LOD score or winter / non-winter run call had insufficient data for WHICHRUN analysis.

ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1
95-001	6/5/95	9.36	W	95-075	7/26/95	8.21	W	96-1039	7/9/96	4.85	W	97-2023	5/9/97		
95-002	6/5/95			95-076	7/26/95	9.92	W	96-1040	7/9/96	9.71	W	97-2024	5/9/97	5.36	W
95-003	6/8/95			95-077	8/3/95			96-1041	7/9/96	5.79	W	97-2025	5/13/97		
95-004	6/8/95	6.21	W	95-078	8/3/95	9.68	W	96-1042	7/9/96			97-2026	5/13/97	6.47	W
95-005	6/21/95	7.40	W	95-079	8/3/95			96-1043	7/9/96	7.14	W	97-2027	5/15/97		
95-006	6/29/95			95-080	8/3/95			96-1044	7/9/96	2.12	W	97-2028	5/16/97		
95-007	6/29/95	8.28	W	95-081	8/3/95			96-1045	7/9/96	8.09	W	97-2029	5/16/97		
95-008	6/29/95			95-082	8/3/95			96-1046	7/9/96	6.21	W	97-2030	5/21/97	11.04	W
95-009	6/29/95			95-083	8/3/95			96-1047	7/9/96	4.51	W	97-2031	5/21/97	-7.09	Non W
95-010	6/29/95			95-084	8/3/95			96-1048	7/9/96			97-2032	5/21/97	3.06	W
95-011	6/29/95	7.40	W	95-085	8/3/95			96-1049	7/9/96			97-2033	5/25/97		
95-012	6/29/95	6.35	W	95-086	8/10/95			96-1050	7/11/96	5.61	W	97-2034	5/25/97	4.84	W
95-013	6/29/95			95-087	8/10/95			96-1051	7/15/96	8.47	W	97-2035	5/27/97		
95-014	6/29/95	9.01	W	95-088	8/10/95			96-1052	7/15/96	2.81	W	97-2036	5/28/97		
95-015	6/29/95			95-089	8/10/95			96-1053	7/15/96			97-2037	5/28/97		
95-016	6/29/95	4.97	W	95-090	8/3/95			96-1054	7/15/96	7.06	W	97-2038	5/28/97	-6.03	Non W
95-017	7/6/95			95-091	8/3/95			96-1055	7/15/96			97-2039	5/30/97		
95-018	7/6/95			95-092	8/3/95			96-1056	7/16/96			97-2040	5/31/97		
95-019	7/6/95	8.32	W	95-094	8/3/95			96-1057	7/16/96	7.96	W	97-2041	6/3/97	10.64	W
95-020	7/6/95			95-095	8/3/95			96-1058	7/16/96			97-2042	6/3/97		
95-021	7/6/95			95-096	8/3/95			96-1059	7/16/96			97-2043	6/3/97		
95-022	7/7/95			95-097	8/3/95			96-1060	7/16/96	2.67	W	97-2044	6/5/97		
95-023	7/11/95	3.89	W	95-098	8/10/95			96-1061	7/16/96			97-2045	6/6/97	2.74	W
95-024	7/11/95	5.78	W	95-099	8/10/95	3.62	W	96-1062	7/16/96	-1.71	Non W	97-2046	6/6/97	9.32	W
95-025	7/11/95			95-100	8/10/95			96-1063	7/16/96	5.91	W	97-2047	6/6/97		
95-026	7/11/95			95-101	8/10/95	0.13	Non W	96-1064	7/16/96			97-2048	6/9/97		
95-027	7/11/95			95-102	8/10/95			96-1065	7/17/96	9.75	W	97-2049	6/9/97		
95-028	7/11/95	7.58	W	95-103	8/10/95			96-1066	7/17/96			97-2050	6/11/97	6.90	W
95-029	7/11/95			95-104	8/10/95			96-1067	7/22/96	6.52	W	97-2051	6/12/97	-2.69	Non W
95-030	7/11/95	4.97	W	95-105	8/17/95			96-1068	7/22/96	5.66	W	97-2052	6/12/97		
95-031	7/11/95			95-106	8/17/95	4.70	W	96-1069	7/22/96	4.00	W	97-2053	6/12/97	11.36	W
95-032	7/11/95	-1.48	Non W	95-107	8/17/95			96-1070	7/22/96			97-2054	6/12/97	5.43	W
95-033	7/11/95	9.55	W	95-109	8/17/95			96-1071	7/22/96	-2.06	Non W	97-2055	6/14/97	7.94	W
95-034	7/11/95			95-110	8/17/95			96-1072	7/23/96			97-2056	6/15/97		
95-035	7/11/95	5.87	W	95-111	8/17/95			96-1073	7/23/96			97-2057	6/15/97	1.90	W
95-036	7/11/95			95-112	8/17/95			96-1074	7/23/96			97-2058	6/17/97	10.77	W
95-037	7/11/95			96-1000	4/29/96			96-1075	7/23/96			97-2059	6/17/97	7.82	W
95-038	7/11/95			96-1001	4/30/96			96-1076	7/24/96	0.73	Non W	97-2060	6/18/97	7.86	W
95-039	7/11/95	8.64	W	96-1002	5/1/96			96-1077	7/29/96	2.98	W	97-2061	6/18/97		
95-040	7/11/95			96-1003	5/6/96	-2.91	Non W	96-1078	7/29/96			97-2062	6/18/97	7.99	W
95-041	7/11/95			96-1004	5/6/96			96-1079	7/29/96			97-2063	6/18/97	6.28	W
95-042	7/11/95	6.40	W	96-1005	5/6/96	-2.41	Non W	96-1080	7/30/96			97-2064	6/20/97		
95-043	7/11/95			96-1006	5/7/96	-6.86	Non W	96-1081	7/30/96			97-2065	6/20/97	9.04	W
95-044	7/11/95			96-1007	5/13/96	-4.99	Non W	96-1082	7/30/96			97-2066	6/21/97		
95-045	7/13/95			96-1008	5/13/96	-3.04	Non W	96-1083	7/31/96	3.31	W	97-2067	6/21/97	6.41	W
95-046	7/13/95			96-1009	5/15/96	-6.72	Non W	96-1084	8/5/96			97-2068	6/21/97	8.08	W
95-047	7/18/95	11.36	W	96-1010	5/15/96			96-1085	8/5/96			97-2069	6/21/97		
95-048	7/18/95	2.91	W	96-1012	5/28/96			96-1086	8/5/96			97-2070	6/23/97	7.12	W
95-049	7/19/95	6.45	W	96-1013	5/28/96			96-1087	8/19/96			97-2071	6/23/97	7.73	W
95-050	7/19/95	10.32	W	96-1014	5/29/96	4.63	W	96-1088	8/22/96		spring?	97-2072	6/23/97		
95-051	7/19/95	5.52	W	96-1015	6/3/96			96-1089	8/27/96			97-2073	6/24/97		
95-052	7/19/95	4.04	W	96-1016	6/4/96	-4.23	Non W	96-1090	8/27/96	-0.54	Non W	97-2074	6/24/97	5.55	W
95-053	7/19/95			96-1017	6/4/96	-2.04	Non W	97-2001	4/30/97			97-2075	6/24/97	8.57	W
95-054	7/19/95			96-1018	6/11/96			97-2002	4/30/97			97-2076	6/24/97	1.33	W
95-055	7/19/95	4.32	W	96-1019	6/17/96	6.82	W	97-2003	4/30/97			97-2077	6/24/97	7.95	W
95-056	7/19/95	4.13	W	96-1020	6/17/96	7.98	W	97-2004	4/30/97	-1.92	Non W	97-2078	6/26/97	4.79	W
95-057	7/24/95	7.86	W	96-1021	6/17/96	7.62	W	97-2005	4/30/97	-8.98	Non W	97-2079	6/27/97		
95-058	7/24/95	4.87	W	96-1022	6/17/96	5.08	W	97-2006	4/30/97	-6.72	Non W	97-2080	6/27/97	7.61	W
95-059	7/26/95	5.88	W	96-1023	6/17/96	7.73	W	97-2007	5/1/97			97-2081	6/27/97		
95-060	7/26/95			96-1024	6/18/96	6.70	W	97-2008	5/3/97	8.02	W	97-2082	6/27/97	6.26	W
95-061	7/26/95			96-1025	6/19/96			97-2009	5/3/97			97-2083	6/29/97		
95-062	7/26/95			96-1026	6/24/96			97-2010	5/3/97	7.99	W	97-2084	6/29/97	8.14	W
95-063	7/26/95	9.49	W	96-1027	6/24/96	8.35	W	97-2011	5/4/97			97-2085	6/29/97		
95-064	7/26/95			96-1028	6/24/96			97-2012	5/4/97			97-2086	6/29/97	2.51	W
95-065	7/26/95			96-1029	6/25/96			97-2013	5/4/97	4.65	W	97-2087	6/30/97		
95-066	7/26/95			96-1030	6/25/96	8.28	W	97-2014	5/4/97	8.38	W	97-2088	6/30/97	8.95	W
95-067	7/26/95			96-1031	6/26/96			97-2015	5/4/97			97-2089	7/2/97		
95-068	7/26/95			96-1032	7/1/96	6.20	W	97-2016	5/4/97	4.22	W	97-2090	7/2/97	7.24	W
95-069	7/26/95	8.55	W	96-1033	7/1/96	8.07	W	97-2017	5/6/97			97-2091	7/2/97		
95-070	7/26/95			96-1034	7/1/96	9.81	W	97-2018	5/7/97			97-2092	7/2/97	8.72	W
95-071	7/26/95	4.51	W	96-1035	7/1/96	10.54	W	97-2019	5/7/97			97-2093	7/3/97	6.80	W
95-072	7/26/95	7.35	W	96-1036	7/2/96	9.89	W	97-2020	5/7/97			97-2094	7/3/97		
95-073	7/26/95			96-1037	7/2/96			97-2021	5/7/97			97-2095	7/3/97	7.89	W
95-074	7/26/95			96-1038	7/2/96			97-2022	5/7/97	0.45	Non W	97-2096	7/3/97	8.09	W

Appendix A. *continued*

ID	COL DATE	LOD	LOD>1
97-2097	7/3/97		
97-2098	7/5/97	9.07	W
97-2099	7/5/97	5.67	W
97-2100	7/5/97	9.74	W
97-2101	7/5/97	6.23	W
97-2102	7/5/97		
97-2103	7/5/97	9.48	W
97-2104	7/6/97	9.12	W
97-2105	7/6/97		
97-2106	7/6/97		
97-2107	7/8/97		
97-2108	7/8/97		
97-2109	7/8/97	2.88	W
97-2110	7/8/97	6.07	W
97-2111	7/9/97		
97-2112	7/9/97	9.53	W
97-2113	7/11/97	12.60	W
97-2114	7/11/97	4.87	W
97-2115	7/12/97	4.85	W
97-2116	7/12/97	6.06	W
97-2117	7/12/97		
97-2118	7/12/97	7.15	W
97-2119	7/12/97	5.50	W
97-2120	7/12/97	8.06	W
97-2121	7/12/97		
97-2122	7/12/97	6.01	W
97-2123	7/12/97	8.02	W
97-2124	7/12/97	4.99	W
97-2125	7/14/97	7.08	W
97-2126	7/15/97	5.75	W
97-2127	7/15/97		
97-2128	7/15/97	5.37	W
97-2129	7/15/97	5.37	W
97-2130	7/15/97	7.18	W
97-2131	7/15/97	11.54	W
97-2132	7/15/97	7.25	W
97-2133	7/15/97		
97-2134	7/17/97	4.93	W
97-2135	7/17/97	6.05	W
97-2136	7/17/97	4.70	W
97-2137	7/17/97	10.73	W
97-2138	7/17/97	7.98	W
97-2139	7/17/97	7.80	W
97-2140	7/17/97	7.79	W
97-2141	7/18/97	6.51	W
97-2142	7/18/97		
97-2143	7/18/97	1.80	W
97-2144	7/18/97	8.06	W
97-2145	7/18/97		
97-2146	7/18/97		
97-2147	7/18/97		
97-2148	7/18/97	5.94	W
97-2149	7/18/97	8.18	W
97-2150	7/18/97	7.62	W
97-2151	7/20/97	7.09	W
97-2152	7/20/97	9.14	W
97-2153	7/20/97		
97-2154	7/20/97	9.32	W
97-2155	7/21/97	8.59	W
97-2156	7/21/97	5.57	W
97-2157	7/21/97	5.23	W
97-2158	7/21/97	2.48	W
97-2159	7/21/97	7.52	W
97-2160	7/21/97	2.67	W
97-2161	7/23/97	5.82	W
97-2162	7/23/97	6.04	W
97-2163	7/23/97	4.61	W
97-2164	7/23/97	1.94	W
97-2165	7/24/97	3.25	W
97-2166	7/24/97		
97-2167	7/24/97		
97-2168	7/24/97	7.38	W
97-2169	7/24/97		
97-2170	7/24/97	4.10	W
97-2171	7/26/97	1.71	W
97-2172	7/26/97		
97-2173	7/26/97	10.71	W
97-2174	7/27/97	8.72	W
97-2175	7/27/97	1.56	W
97-2176	7/27/97	4.34	W
97-2177	7/27/97	3.64	W
97-2178	7/29/97	5.71	W
97-2179	7/29/97	5.87	W
97-2180	7/29/97		
97-2181	7/29/97	7.39	W
97-2182	7/30/97	4.95	W
97-2183	8/1/97	3.65	W
97-2184	8/1/97		
97-2185	8/2/97	8.67	W
97-2186	8/2/97		
97-2187	8/2/97		
97-2188	8/2/97		
97-2189	8/4/97		
97-2190	8/4/97		
97-2191	8/4/97	6.50	W
97-2192	8/5/97	3.77	W
97-2193	8/7/97	2.87	W
97-2194	8/7/97	3.36	W
97-2195	8/8/97	1.63	W
97-2196	8/8/97		
97-2197	8/10/97	8.89	W
97-2198	8/10/97		
97-2199	8/10/97		
97-2200	8/10/97		
97-2201	8/10/97		
97-2202	8/13/97		
97-2203	8/17/97	4.71	W
97-2204	8/29/97		
98-4001	5/5/98	9.85	W
98-4002	5/5/98	-3.83	Non W
98-4003	5/5/98	3.17	W
98-4004	5/5/98	8.24	W
98-4005	5/5/98	2.01	W
98-4006	5/5/98	8.73	W
98-4007	5/6/98	6.79	W
98-4008	5/6/98	5.67	W
98-4009	5/6/98	7.40	W
98-4010	5/6/98	5.44	W
98-4011	5/6/98	4.92	W
98-4012	5/6/98	5.47	W
98-4013	5/6/98	9.02	W
98-4014	5/6/98	-7.77	Non W
98-4015	5/6/98		
98-4016	5/8/98	5.76	W
98-4017	5/8/98	7.53	W
98-4018	5/8/98	-5.47	Non W
98-4019	5/8/98	5.04	W
98-4020	5/8/98	5.95	W
98-4021	5/8/98	8.95	W
98-4022	5/9/98	9.20	W
98-4023	5/9/98	8.44	W
98-4024	5/9/98	-5.50	Non W
98-4025	5/11/98	5.53	W
98-4026	5/11/98	5.98	W
98-4027	5/11/98	8.44	W
98-4028	5/11/98	-2.82	Non W
98-4029	5/11/98	6.84	W
98-4030	5/12/98	5.05	W
98-4031	5/12/98	0.93	W
98-4032	5/12/98	11.78	W
98-4033	5/12/98	8.28	W
98-4034	5/12/98	-6.37	Non W
98-4035	5/12/98	7.92	W
98-4036	5/14/98	4.74	W
98-4037	5/14/98	4.46	W
98-4038	5/14/98	8.70	W
98-4039	5/14/98	-6.22	Non W
98-4040	5/14/98	6.18	W
98-4041	5/14/98	-4.26	Non W
98-4042	5/15/98	10.16	W
98-4043	5/15/98	-8.47	Non W
98-4044	5/15/98	5.74	W
98-4045	5/15/98	0.76	Non W
98-4046	5/15/98		
98-4047	5/15/98	9.49	W
98-4048	5/17/98	8.17	W
98-4049	5/17/98	10.89	W
98-4050	5/17/98	7.45	W
98-4051	5/17/98	-8.47	Non W
98-4052	5/18/98		
98-4053	5/18/98		
98-4054	5/18/98	7.72	W
98-4055	5/18/98	7.33	W
98-4056	5/18/98	7.18	W
98-4057	5/18/98	8.76	W
98-4058	5/18/98	5.22	W
98-4059	5/18/98	7.70	W
98-4060	5/18/98	6.09	W
98-4061	5/18/98	11.62	W
98-4062	5/18/98		
98-4063	5/18/98	6.48	W
98-4064	5/18/98	-6.12	Non W
98-4065	5/20/98		
98-4066	5/20/98	7.25	W
98-4067	5/20/98	7.68	W
98-4068	5/21/98	9.04	W
98-4069	5/21/98	6.23	W
98-4070	5/21/98	4.29	W
98-4071	5/21/98	8.02	W
98-4072	5/21/98	-5.79	Non W
98-4073	5/21/98	4.28	W
98-4074	5/21/98	6.04	W
98-4075	5/23/98	8.78	W
98-4076	5/23/98	6.56	W
98-4077	5/23/98	7.61	W
98-4078	5/24/98	7.05	W
98-4079	5/24/98	5.15	W
98-4080	5/24/98	7.16	W
98-4081	5/24/98	3.70	W
98-4082	5/24/98	7.68	W
98-4083	5/24/98	5.32	W
98-4084	5/26/98	7.90	W
98-4085	5/26/98	6.53	W
98-4086	5/26/98	4.90	W
98-4087	5/26/98	9.46	W
98-4088	5/26/98	5.94	W
98-4089	5/27/98	4.01	W
98-4090	5/27/98	4.11	W
98-4091	5/27/98	10.64	W
98-4092	5/27/98	5.14	W
98-4093	5/27/98	4.03	W
98-4094	5/27/98	6.72	W
98-4095	5/27/98	5.22	W
98-4096	5/27/98	9.70	W
98-4097	5/27/98	7.09	W
98-4098	6/1/98	-1.74	Non W
98-4099	6/2/98	1.96	W
98-4100	6/2/98	6.86	W
98-4101	6/2/98	4.05	W
98-4102	6/2/98	2.36	W
98-4103	6/2/98	3.97	W
98-4104	6/2/98	1.54	W
98-4105	6/4/98	8.81	W
98-4106	6/4/98	2.42	W
98-4107	6/4/98	7.70	W
98-4108	6/4/98	7.75	W
98-4109	6/4/98	8.64	W
98-4110	6/4/98	6.41	W
98-4111	6/4/98	6.45	W
98-4112	6/5/98	6.08	W
98-4113	6/5/98	9.00	W
98-4114	6/5/98	12.39	W
98-4115	6/7/98	4.25	W
98-4116	6/7/98	12.50	W
98-4117	6/7/98	8.72	W
98-4118	6/7/98	-5.10	Non W
98-4119	6/8/98	6.83	W
98-4120	6/8/98	5.86	W
98-4121	6/8/98	7.58	W
98-4122	6/8/98	8.72	W
98-4123	6/8/98	6.20	W
98-4124	6/8/98	7.02	W
98-4125	6/8/98	7.59	W
98-4126	6/8/98	4.08	W
98-4127	6/8/98	4.36	W
98-4128	6/8/98	7.82	W
98-4129	6/10/98	3.15	W
98-4130	6/10/98	7.87	W
98-4131	6/10/98	7.80	W
98-4132	6/10/98	8.50	W
98-4133	6/10/98	6.65	W
98-4134	6/10/98	9.27	W
98-4135	6/10/98	7.99	W
98-4136	6/10/98	2.09	W
98-4137	6/10/98	-5.76	Non W
98-4138	6/10/98	4.32	W
98-4139	6/10/98	9.63	W
98-4140	6/10/98	8.14	W
98-4141	6/10/98	3.85	W
98-4142	6/10/98	4.64	W
98-4143	6/10/98	10.01	W
98-4144	6/11/98	6.53	W
98-4145	6/11/98	5.73	W
98-4146	6/11/98	6.39	W
98-4147	6/11/98		
98-4148	6/11/98	6.62	W
98-4149	6/11/98	3.63	W
98-4150	6/11/98	7.93	W
98-4151	6/11/98	3.02	W
98-4152	6/11/98	9.46	W
98-4153	6/11/98		
98-4154	6/11/98	3.70	W
98-4155	6/11/98	8.85	W
98-4156	6/11/98	6.37	W
98-4157	6/11/98	0.42	Non W
98-4158	6/11/98	6.05	W
98-4159	6/11/98	1.60	W
98-4160	6/11/98	6.65	W
98-4161	6/11/98	2.44	W
98-4162	6/11/98	9.78	W
98-4163	6/11/98	3.25	W
98-4164	6/11/98	2.96	W
98-4165	6/11/98	5.07	W
98-4166	6/13/98	9.22	W
98-4167	6/13/98	7.38	W
98-4168	6/13/98	4.84	W
98-4169	6/13/98	3.56	W
98-4170	6/13/98	1.80	W
98-4171	6/13/98	3.57	W
98-4172	6/14/98	7.13	W
98-4173	6/14/98	5.05	W
98-4174	6/14/98	6.71	W
98-4175	6/14/98	4.60	W
98-4176	6/14/98	9.80	W
98-4177	6/14/98	6.81	W
98-4178	6/14/98	1.45	W
98-4179	6/14/98	3.89	W
98-4180	6/14/98	9.97	W
98-4181	6/14/98	8.35	W
98-4182	6/16/98	3.87	W
98-4183	6/16/98	5.08	W
98-4184	6/16/98	3.85	W
98-4185	6/16/98	7.81	W
98-4186	6/16/98	8.18	W
98-4187	6/16/98	5.58	W
98-4188	6/16/98	5.27	W
98-4189	6/17/98	10.90	W
98-4190	6/17/98		
98-4191	6/17/98	12.57	W
98-4192	6/17/98	7.53	W

Appendix A. *continued*

ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1
98-4193	6/17/98	9.20	W	98-4268	6/25/98	7.73	W	98-4343	7/1/98	4.01	W	98-4418	7/5/98		
98-4194	6/17/98			98-4269	6/25/98	7.30	W	98-4344	7/1/98			98-4419	7/7/98	1.97	W
98-4195	6/17/98	9.81	W	98-4270	6/25/98	6.92	W	98-4345	7/1/98			98-4420	7/7/98	6.59	W
98-4196	6/17/98	12.02	W	98-4271	6/25/98	10.06	W	98-4346	7/1/98	8.30	W	98-4421	7/7/98		
98-4197	6/17/98	6.98	W	98-4272	6/25/98	8.31	W	98-4347	7/1/98	2.33	W	98-4422	7/7/98	5.36	W
98-4198	6/17/98	8.86	W	98-4273	6/25/98	7.53	W	98-4348	7/1/98			98-4423	7/7/98	5.50	W
98-4199	6/17/98	12.61	W	98-4274	6/25/98	11.56	W	98-4349	7/1/98	8.26	W	98-4424	7/7/98		
98-4200	6/17/98	9.15	W	98-4275	6/25/98	5.10	W	98-4350	7/1/98			98-4425	7/7/98	8.21	W
98-4201	6/17/98	9.66	W	98-4276	6/25/98	9.80	W	98-4351	7/1/98			98-4426	7/7/98		
98-4202	6/17/98			98-4277	6/25/98	7.06	W	98-4352	7/1/98	7.17	W	98-4427	7/7/98	10.44	W
98-4203	6/19/98	6.30	W	98-4278	6/25/98	7.13	W	98-4353	7/1/98			98-4428	7/7/98	8.10	W
98-4204	6/19/98	4.86	W	98-4279	6/25/98	9.32	W	98-4354	7/1/98	0.97	non W	98-4429	7/7/98	3.35	W
98-4205	6/19/98	4.08	W	98-4280	6/25/98	7.03	W	98-4355	7/1/98	8.32	W	98-4430	7/7/98	3.14	W
98-4206	6/19/98	5.63	W	98-4281	6/25/98	6.21	W	98-4356	7/1/98	8.85	W	98-4431	7/7/98	6.72	W
98-4207	6/19/98	7.53	W	98-4282	6/26/98	7.12	W	98-4357	7/1/98	8.00	W	98-4432	7/8/98	11.26	W
98-4208	6/19/98	6.48	W	98-4283	6/26/98	4.67	W	98-4358	7/1/98	10.46	W	98-4433	7/8/98	9.19	W
98-4209	6/19/98	6.87	W	98-4284	6/26/98	9.15	W	98-4359	7/1/98	7.24	W	98-4434	7/8/98	5.52	W
98-4210	6/19/98	6.24	W	98-4285	6/26/98	8.45	W	98-4360	7/1/98	6.02	W	98-4435	7/8/98		
98-4211	6/19/98	6.78	W	98-4286	6/26/98	5.71	W	98-4361	7/1/98	6.24	W	98-4436	7/8/98	1.00	W
98-4212	6/19/98			98-4287	6/26/98			98-4362	7/1/98	6.62	W	98-4437	7/8/98	9.48	W
98-4213	6/19/98	5.61	W	98-4288	6/26/98			98-4363	7/1/98	6.52	W	98-4438	7/8/98	7.32	W
98-4214	6/19/98	8.08	W	98-4289	6/26/98	7.27	W	98-4364	7/1/98	5.13	W	98-4439	7/8/98	7.90	W
98-4215	6/19/98	10.11	W	98-4290	6/26/98	2.37	W	98-4365	7/1/98	10.00	W	98-4440	7/10/98	1.16	W
98-4216	6/19/98	8.02	W	98-4291	6/26/98			98-4366	7/1/98	9.64	W	98-4441	7/10/98	5.10	W
98-4217	6/19/98	7.81	W	98-4292	6/26/98	9.62	W	98-4367	7/1/98			98-4442	7/10/98	3.89	W
98-4218	6/19/98	10.34	W	98-4293	6/26/98	4.48	W	98-4368	7/1/98	4.39	W	98-4443	7/10/98	8.78	W
98-4219	6/19/98	6.98	W	98-4294	6/26/98	7.17	W	98-4369	7/1/98	9.62	W	98-4444	7/10/98	1.32	W
98-4220	6/20/98	4.76	W	98-4295	6/28/98	7.52	W	98-4370	7/2/98	1.68	W	98-4445	7/10/98	9.08	W
98-4221	6/20/98	7.82	W	98-4296	6/28/98			98-4371	7/2/98	7.49	W	98-4446	7/10/98		
98-4222	6/20/98	4.51	W	98-4297	6/28/98			98-4372	7/2/98			98-4447	7/10/98	10.22	W
98-4223	6/20/98	9.62	W	98-4298	6/28/98	4.51	W	98-4373	7/2/98	2.14	W	98-4448	7/10/98	5.85	W
98-4224	6/20/98	7.47	W	98-4299	6/28/98	11.62	W	98-4374	7/2/98			98-4449	7/10/98	6.52	W
98-4225	6/20/98	3.60	W	98-4300	6/28/98			98-4375	7/2/98	0.77	Non W	98-4450	7/10/98	7.38	W
98-4226	6/20/98	3.80	W	98-4301	6/28/98			98-4376	7/2/98	-7.61	Non W	98-4451	7/10/98	5.18	W
98-4227	6/20/98	7.22	W	98-4302	6/28/98			98-4377	7/2/98	5.95	W	98-4452	7/11/98	5.44	W
98-4228	6/20/98	7.83	W	98-4303	6/28/98	9.40	W	98-4378	7/2/98	7.35	W	98-4453	7/11/98		
98-4229	6/20/98	6.30	W	98-4304	6/28/98	6.60	W	98-4379	7/2/98	9.72	W	98-4454	7/11/98	5.58	W
98-4230	6/20/98	3.02	W	98-4305	6/28/98	1.81	W	98-4380	7/2/98			98-4455	7/11/98	9.84	W
98-4231	6/20/98	1.52	W	98-4306	6/28/98			98-4381	7/4/98	6.18	W	98-4456	7/11/98	3.15	W
98-4232	6/20/98	6.73	W	98-4307	6/28/98	7.32	W	98-4382	7/4/98			98-4457	7/11/98	4.89	W
98-4233	6/22/98	1.91	W	98-4308	6/28/98	7.72	W	98-4383	7/4/98	10.30	W	98-4458	7/11/98	8.60	W
98-4234	6/22/98	6.34	W	98-4309	6/28/98	2.26	W	98-4384	7/4/98	1.35	W	98-4459	7/11/98	5.65	W
98-4235	6/22/98	3.04	W	98-4310	6/28/98	8.36	W	98-4385	7/4/98	8.86	W	98-4460	7/11/98	11.68	W
98-4236	6/22/98	5.66	W	98-4311	6/29/98	10.44	W	98-4386	7/4/98	10.05	W	98-4461	7/13/98	7.37	W
98-4237	6/22/98	8.49	W	98-4312	6/29/98	2.48	W	98-4387	7/4/98	5.73	W	98-4462	7/13/98	7.12	W
98-4238	6/22/98	5.42	W	98-4313	6/29/98			98-4388	7/4/98	3.82	W	98-4463	7/13/98	2.38	W
98-4239	6/22/98	5.67	W	98-4314	6/29/98	6.84	W	98-4389	7/4/98	4.13	W	98-4464	7/13/98	5.86	W
98-4240	6/22/98	6.17	W	98-4315	6/29/98	2.84	W	98-4390	7/4/98	1.17	W	98-4465	7/13/98	5.11	W
98-4241	6/22/98	5.83	W	98-4316	6/29/98	7.71	W	98-4391	7/4/98	5.31	W	98-4466	7/13/98	5.15	W
98-4242	6/22/98	11.13	W	98-4317	6/29/98			98-4392	7/4/98	5.36	W	98-4467	7/13/98	7.90	W
98-4243	6/22/98	6.49	W	98-4318	6/29/98			98-4393	7/5/98	9.21	W	98-4468	7/13/98	6.49	W
98-4244	6/22/98	5.08	W	98-4319	6/29/98	7.25	W	98-4394	7/5/98	2.68	W	98-4469	7/13/98		
98-4245	6/22/98	7.33	W	98-4320	6/29/98	6.73	W	98-4395	7/5/98	8.24	W	98-4470	7/13/98	6.60	W
98-4246	6/22/98	4.31	W	98-4321	6/29/98	7.98	W	98-4396	7/5/98	7.18	W	98-4471	7/13/98	8.12	W
98-4247	6/22/98	7.36	W	98-4322	6/29/98	9.76	W	98-4397	7/5/98	9.39	W	98-4472	7/13/98	7.31	W
98-4248	6/22/98	10.58	W	98-4323	6/29/98	3.58	W	98-4398	7/5/98			98-4473	7/13/98	4.58	W
98-4249	6/22/98	7.85	W	98-4324	6/29/98	2.41	W	98-4399	7/5/98			98-4474	7/13/98	7.59	W
98-4250	6/22/98	7.14	W	98-4325	6/29/98	9.99	W	98-4400	7/5/98	5.91	W	98-4475	7/13/98	7.78	W
98-4251	6/23/98	6.44	W	98-4326	6/29/98	8.92	W	98-4401	7/5/98	5.02	W	98-4476	7/13/98		
98-4252	6/23/98	7.52	W	98-4327	6/29/98			98-4402	7/5/98	2.27	W	98-4477	7/13/98	6.43	W
98-4253	6/23/98	4.75	W	98-4328	6/29/98			98-4403	7/5/98			98-4478	7/13/98	2.52	W
98-4254	6/23/98	8.63	W	98-4329	6/29/98	3.63	W	98-4404	7/5/98	3.26	W	98-4479	7/13/98	6.20	W
98-4255	6/23/98	8.40	W	98-4330	6/29/98			98-4405	7/5/98	8.21	W	98-4480	7/13/98	9.01	W
98-4256	6/23/98	8.50	W	98-4331	6/29/98	6.53	W	98-4406	7/5/98	7.43	W	98-4481	7/14/98	9.48	W
98-4257	6/23/98	2.50	W	98-4332	6/29/98			98-4407	7/5/98	7.94	W	98-4482	7/14/98	4.07	W
98-4258	6/23/98	7.00	W	98-4333	?	7.55	W	98-4408	7/5/98	9.56	W	98-4483	7/14/98	6.88	W
98-4259	6/23/98	5.43	W	98-4334	7/1/98	3.93	W	98-4409	7/5/98	5.90	W	98-4484	7/14/98	10.05	W
98-4260	6/23/98	6.55	W	98-4335	7/1/98	8.89	W	98-4410	7/5/98	5.64	W	98-4485	7/14/98		
98-4261	6/23/98			98-4336	7/1/98	6.73	W	98-4411	7/5/98	6.29	W	98-4486	7/14/98	7.32	W
98-4262	6/23/98			98-4337	7/1/98	7.82	W	98-4412	7/5/98			98-4487	7/14/98	3.98	W
98-4263	6/23/98	7.60	W	98-4338	7/1/98	-0.38	Non W	98-4413	7/5/98			98-4488	7/14/98	4.92	W
98-4264	6/23/98	4.34	W	98-4339	7/1/98	1.53	W	98-4414	7/5/98	1.06	W	98-4489	7/14/98	4.41	W
98-4265	6/25/98	1.74	W	98-4340	7/1/98	8.92	W	98-4415	7/5/98			98-4490	7/14/98	6.98	W
98-4266	6/25/98	4.83	W	98-4341	7/1/98			98-4416	7/5/98	4.75	W	98-4491	7/16/98	5.62	W
98-4267	6/25/98	9.16	W	98-4342	7/1/98	6.73	W	98-4417	7/5/98			98-4492	7/16/98	3.46	W

Appendix A. *continued*

ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1
98-4493	7/16/98	7.79	W	98-4568	8/3/98	0.44	non W	99-5053	6/2/99	8.82	W	99-5128	6/17/99	10.15	W
98-4494	7/16/98	6.81	W	98-4569	8/4/98	5.92	W	99-5054	6/4/99	9.89	W	99-5129	6/17/99	10.93	W
98-4495	7/16/98	7.38	W	98-4570	8/4/98	8.03	W	99-5055	6/4/99	9.89	W	99-5130	6/17/99		
98-4496	7/16/98	9.63	W	98-4571	8/6/98	7.06	W	99-5056	6/4/99	4.00	W	99-5131	6/19/99	9.44	W
98-4497	7/16/98			98-4572	8/6/98	9.92	W	99-5057	6/4/99	2.76	W	99-5132	6/19/99	9.92	W
98-4498	7/16/98	9.68	W	98-4573	8/6/98	10.20	W	99-5058	6/4/99	7.36	W	99-5133	6/19/99	4.46	W
98-4499	7/16/98			98-4574	8/6/98	9.10	W	99-5059	6/4/99	6.80	W	99-5134	6/19/99	10.99	W
98-4500	7/16/98	7.30	W	98-4575	8/6/98	3.26	W	99-5060	6/4/99	9.27	W	99-5135	6/19/99	12.09	W
98-4501	7/16/98	6.29	W	98-4576	8/6/98	6.40	W	99-5061	6/4/99	7.81	W	99-5136	6/19/99	8.23	W
98-4502	7/16/98	10.76	W	98-4577	8/6/98	3.61	W	99-5062	6/4/99			99-5137	6/19/99		
98-4503	7/16/98	7.05	W	98-4578	8/7/98	3.94	W	99-5063	6/4/99	5.75	W	99-5138	6/19/99	4.84	W
98-4504	7/16/98	7.74	W	98-4579	8/9/98	7.11	W	99-5064	6/4/99	3.42	W	99-5140	6/19/99	5.87	W
98-4505	7/17/98			98-4580	8/9/98	10.80	W	99-5065	6/5/99			99-5141	6/19/99	9.78	W
98-4506	7/17/98	7.10	W	98-4581	8/9/98	2.05	W	99-5066	6/5/99	-7.90	Non W	99-5142	6/19/99	10.05	W
98-4507	7/17/98	4.10	W	98-4582	8/10/98	8.97	W	99-5067	6/5/99	7.48	W	99-5143	6/19/99	10.08	W
98-4508	7/19/98	3.42	W	98-4583	8/12/98	2.93	W	99-5068	6/5/99	8.89	W	99-5144	6/22/99	10.27	W
98-4509	7/19/98	6.47	W	98-4584	8/12/98			99-5069	6/7/99	5.73	W	99-5145	6/22/99	7.54	W
98-4510	7/19/98	7.29	W	98-4585	8/15/98	6.85	W	99-5070	6/7/99	9.43	W	99-5146	6/22/99	5.39	W
98-4511	7/19/98	6.41	W	98-4586	8/15/98	8.73	W	99-5071	6/7/99	8.71	W	99-5147	6/22/99	6.41	W
98-4512	7/19/98	9.90	W	98-4587	8/15/98			99-5072	6/7/99	5.80	W	99-5148	6/22/99	-5.13	Non W
98-4513	7/19/98	3.27	W	98-4588	8/18/98	0.92	W	99-5073	6/7/99	6.74	W	99-5149	6/22/99	3.59	W
98-4514	7/19/98	7.26	W	98-4589	8/21/98	0.42	W	99-5074	6/7/99	8.44	W	99-5150	6/22/99		
98-4515	7/20/98	4.91	W	98-4590	8/24/98	-4.15	Non W	99-5075	6/7/99	9.39	W	99-5151	6/22/99	8.05	W
98-4516	7/20/98	-0.12	Non W	99-5001	5/5/99	10.51	W	99-5076	6/7/99	6.06	W	99-5152	6/22/99	6.87	W
98-4517	7/20/98	6.32	W	99-5002	5/5/99	-8.04	Non W	99-5077	6/7/99	3.70	W	99-5153	6/22/99	7.89	W
98-4518	7/20/98	9.14	W	99-5003	5/5/99	-2.97	Non W	99-5078	6/7/99	10.87	W	99-5154	6/22/99	8.86	W
98-4519	7/20/98	10.15	W	99-5004	5/5/99	-7.55	Non W	99-5079	6/7/99	1.59	W	99-5155	6/22/99	3.55	W
98-4520	7/22/98	4.44	W	99-5005	5/5/99	-6.37	Non W	99-5080	6/7/99	7.87	W	99-5156	6/23/99	9.44	W
98-4521	7/22/98	8.32	W	99-5006	5/5/99	-6.50	Non W	99-5081	6/7/99	5.65	W	99-5157	6/23/99		
98-4522	7/22/98			99-5007	5/5/99			99-5082	6/7/99	6.66	W	99-5158	6/23/99	4.81	W
98-4523	7/22/98	7.89	W	99-5008	5/5/99	-2.04	Non W	99-5083	6/8/99	-5.71	Non W	99-5159	6/23/99	6.68	W
98-4524	7/22/98	5.74	W	99-5009	5/6/99	-2.97	Non W	99-5084	6/8/99	7.57	W	99-5160	6/23/99	5.39	W
98-4525	7/22/98			99-5010	5/9/99	-3.14	Non W	99-5085	6/8/99	8.15	W	99-5161	6/23/99	9.23	W
98-4526	7/22/98	3.96	W	99-5011	5/11/99	-3.99	Non W	99-5086	6/8/99	9.63	W	99-5162	6/23/99	4.61	W
98-4527	7/22/98	5.53	W	99-5012	5/11/99	9.55	W	99-5087	6/8/99	9.78	W	99-5163	6/25/99	4.16	W
98-4528	7/22/98	8.18	W	99-5013	5/11/99	7.75	W	99-5088	6/8/99	9.55	W	99-5164	6/25/99	10.76	W
98-4529	7/22/98			99-5014	5/11/99	-4.88	Non W	99-5089	6/8/99	4.66	W	99-5165	6/25/99	5.69	W
98-4530	7/23/98	8.58	W	99-5015	5/12/99	-4.10	Non W	99-5090	6/10/99	6.87	W	99-5166	6/25/99	8.50	W
98-4531	7/23/98			99-5016	5/12/99	-5.35	Non W	99-5091	6/10/99	7.74	W	99-5167	6/25/99	2.86	W
98-4532	7/23/98	9.24	W	99-5017	5/12/99	9.25	W	99-5092	6/10/99	2.81	W	99-5168	6/25/99		
98-4533	7/25/98	10.24	W	99-5018	5/14/99	6.99	W	99-5093	6/10/99	4.62	W	99-5169	6/25/99	5.94	W
98-4534	7/25/98	4.61	W	99-5019	5/14/99	9.87	W	99-5094	6/10/99	7.62	W	99-5170	6/25/99	2.54	W
98-4535	7/26/98	3.43	W	99-5020	5/14/99	9.43	W	99-5095	6/10/99	9.48	W	99-5171	6/25/99	9.58	W
98-4536	7/26/98	4.35	W	99-5021	5/15/99	7.50	W	99-5096	6/10/99	7.90	W	99-5172	6/25/99	5.91	W
98-4537	7/28/98	8.43	W	99-5022	5/17/99	10.70	W	99-5097	6/10/99	9.63	W	99-5173	6/25/99		
98-4538	7/28/98			99-5023	5/17/99	-5.78	Non W	99-5098	6/10/99	6.46	W	99-5174	6/25/99	11.10	W
98-4539	7/28/98			99-5024	5/17/99	-4.74	Non W	99-5099	6/10/99			99-5175	6/25/99	8.44	W
98-4540	7/28/98	2.37	W	99-5025	5/17/99	3.78	W	99-5100	6/10/99	9.15	W	99-5176	6/25/99	8.07	W
98-4541	7/28/98	9.45	W	99-5026	5/18/99	8.01	W	99-5101	6/10/99			99-5177	6/26/99		
98-4542	7/28/98	7.86	W	99-5027	5/18/99	7.54	W	99-5102	6/11/99	5.72	W	99-5178	6/26/99	4.34	W
98-4543	7/28/98	5.45	W	99-5028	5/23/99	4.11	W	99-5103	6/13/99	3.10	W	99-5179	6/26/99	-6.85	Non W
98-4544	7/28/98	2.78	W	99-5029	5/23/99	4.26	W	99-5104	6/13/99	8.00	W	99-5180	6/26/99	8.11	W
98-4545	7/28/98	5.71	W	99-5030	5/23/99			99-5105	6/13/99	7.33	W	99-5181	6/26/99	6.29	W
98-4546	7/28/98	9.53	W	99-5031	5/24/99	-5.87	Non W	99-5106	6/13/99	9.54	W	99-5182	6/26/99	4.68	W
98-4547	7/28/98	6.76	W	99-5032	5/24/99	6.89	W	99-5107	6/13/99	11.91	W	99-5183	6/26/99		
98-4548	7/28/98	6.04	W	99-5033	5/26/99			99-5108	6/13/99	9.31	W	99-5184	6/26/99	8.59	W
98-4549	7/31/98	6.83	W	99-5034	5/26/99	-4.44	Non W	99-5109	6/14/99	10.78	W	99-5185	6/26/99	8.70	W
98-4550	7/31/98	7.71	W	99-5035	5/26/99	9.84	W	99-5110	6/14/99	4.99	W	99-5186	6/28/99	7.56	W
98-4551	7/31/98	7.62	W	99-5036	5/26/99			99-5111	6/14/99			99-5187	6/28/99	5.77	W
98-4552	7/31/98	5.97	W	99-5037	5/26/99	7.24	W	99-5112	6/14/99	7.93	W	99-5188	6/28/99	8.89	W
98-4553	7/31/98	2.82	W	99-5038	5/27/99			99-5113	6/16/99	4.01	W	99-5189	6/28/99	4.08	W
98-4554	7/31/98	4.36	W	99-5039	5/27/99			99-5114	6/16/99	11.57	W	99-5190	6/28/99	8.34	W
98-4555	8/1/98	-7.16	Non W	99-5040	5/27/99	6.57	W	99-5115	6/16/99	5.20	W	99-5191	6/28/99		
98-4556	8/3/98			99-5041	5/30/99	6.85	W	99-5116	6/16/99	9.14	W	99-5192	6/28/99	5.80	W
98-4557	8/3/98	9.26	W	99-5042	5/30/99			99-5117	6/16/99	7.49	W	99-5193	6/28/99	9.09	W
98-4558	8/3/98			99-5043	5/30/99	6.86	W	99-5118	6/16/99	7.34	W	99-5194	6/28/99	5.09	W
98-4559	8/3/98			99-5044	6/1/99			99-5119	6/16/99	7.53	W	99-5195	6/28/99	6.37	W
98-4560	8/3/98	5.71	W	99-5045	6/1/99	9.51	W	99-5120	6/16/99	7.90	W	99-5196	6/29/99	6.71	W
98-4561	8/3/98	9.04	W	99-5046	6/1/99	4.90	W	99-5121	6/16/99	8.00	W	99-5197	6/29/99	9.64	W
98-4562	8/3/98			99-5047	6/1/99	7.38	W	99-5122	6/16/99	6.65	W	99-5198	6/29/99		
98-4563	8/3/98	4.48	W	99-5048	6/1/99	11.25	W	99-5123	6/16/99	10.06	W	99-5199	6/29/99	4.26	W
98-4564	8/3/98	4.53	W	99-5049	6/1/99	7.25	W	99-5124	6/16/99	5.88	W	99-5200	6/29/99	6.52	W
98-4565	8/3/98			99-5050	6/2/99			99-5125	6/16/99	6.33	W	99-5201	6/29/99	3.38	W
98-4566	8/3/98			99-5051	6/2/99	7.26	W	99-5126	6/17/99	11.87	W	99-5202	6/29/99	6.31	W
98-4567	8/3/98	4.93	W	99-5052	6/2/99	-4.80	Non W	99-5127	6/17/99	8.93	W	99-5203	7/2/99	5.83	W

Appendix A. *continued*

ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1
99-5204	7/2/99	4.28	W	99-5279	7/21/99	5.98	W	00-4631	5/9/00	3.00	W	00-4706	5/18/00	6.55	W
99-5205	7/2/99	6.48	W	99-5280	7/21/99	5.55	W	00-4632	5/9/00	-6.27	Non W	00-4707	5/18/00	6.60	W
99-5206	7/2/99	12.40	W	99-5281	7/21/99	2.90	W	00-4633	5/9/00	10.20	W	00-4708	5/18/00	10.65	W
99-5207	7/2/99	3.87	W	99-5282	7/21/99			00-4634	5/9/00	2.48	W	00-4709	5/18/00	5.13	W
99-5208	7/3/99			99-5283	7/21/99	5.88	W	00-4635	5/9/00	8.72	W	00-4710	5/18/00	7.68	W
99-5209	7/3/99	3.78	W	99-5284	7/21/99	7.73	W	00-4636	5/10/00	9.98	W	00-4711	5/18/00	2.63	W
99-5210	7/3/99	3.63	W	99-5285	7/21/99	12.01	W	00-4637	5/10/00	2.26	W	00-4712	5/18/00	8.47	W
99-5211	7/3/99			99-5286	7/21/99	8.82	W	00-4638	5/10/00	4.17	W	00-4713	5/18/00	-0.39	Non W
99-5212	7/6/99	-0.33	Non W	99-5287	7/22/99	9.62	W	00-4639	5/10/00			00-4732	5/18/00		W
99-5213	7/6/99	10.05	W	99-5288	7/22/99	2.17	W	00-4640	5/10/00	6.29	W	00-4734	5/19/00	5.12	W
99-5214	7/6/99	6.45	W	99-5289	7/22/99			00-4641	5/12/00	6.06	W	00-4735	5/19/00	5.12	W
99-5215	7/6/99	9.08	W	99-5290	7/24/99	7.43	W	00-4642	5/12/00	6.72	W	00-4736	5/19/00		
99-5216	7/6/99	5.07	W	99-5291	7/24/99	8.73	W	00-4643	5/12/00	-0.70	Non W	00-4737	5/19/00	3.40	W
99-5217	7/6/99	5.98	W	99-5292	7/24/99	4.42	W	00-4644	5/12/00	9.22	W	00-4738	5/19/00	9.56	W
99-5218	7/6/99	6.51	W	99-5293	7/24/99	7.40	W	00-4645	5/12/00			00-4739	5/19/00	5.47	W
99-5219	7/6/99	10.32	W	99-5294	7/25/99	3.02	W	00-4646	5/12/00	8.39	W	00-4740	5/19/00	2.67	W
99-5220	7/6/99	9.82	W	99-5295	7/25/99	3.20	W	00-4647	5/12/00			00-4741	5/19/00	4.25	W
99-5221	7/6/99	5.36	W	99-5296	7/27/99	10.45	W	00-4648	5/12/00	8.62	W	00-4742	5/19/00	8.59	W
99-5222	7/6/99	9.10	W	99-5297	7/27/99	8.51	W	00-4649	5/12/00	5.69	W	00-4743	5/19/00	7.33	W
99-5223	7/7/99	3.30	W	99-5298	7/28/99	8.94	W	00-4650	5/12/00	10.19	W	00-4744	5/19/00	5.63	W
99-5224	7/7/99	5.30	W	99-5299	7/28/99			00-4651	5/12/00	6.73	W	00-4745	5/19/00	5.85	W
99-5225	7/7/99	9.07	W	99-5300	7/30/99			00-4652	5/12/00	5.39	W	00-4746	5/19/00	6.65	W
99-5226	7/7/99	9.23	W	99-5301	7/30/99			00-4653	5/12/00	5.80	W	00-4747	5/21/00	6.34	W
99-5227	7/7/99	11.06	W	99-5302	7/30/99	10.30	W	00-4654	5/12/00	-9.04	Non W	00-4748	5/21/00	9.60	W
99-5228	7/9/99	6.31	W	99-5303	7/30/99	10.38	W	00-4655	5/12/00	11.19	W	00-4749	5/21/00	7.85	W
99-5229	7/9/99	4.07	W	99-5304	7/31/99			00-4656	5/12/00	2.72	W	00-4750	5/21/00	10.36	W
99-5230	7/9/99	6.51	W	99-5305	8/2/99	6.98	W	00-4657	5/12/00	6.07	W	00-4751	5/21/00	7.14	W
99-5231	7/9/99	7.29	W	99-5306	8/2/99	6.39	W	00-4658	5/12/00			00-4752	5/21/00	5.78	W
99-5232	7/9/99	4.88	W	99-5307	8/3/99			00-4659	5/12/00	6.76	W	00-4753	5/21/00	7.92	W
99-5233	7/9/99	7.22	W	99-5308	8/3/99	7.28	W	00-4660	5/12/00	8.73	W	00-4754	5/21/00	9.87	W
99-5234	7/9/99	5.91	W	99-5309	8/5/99	6.73	W	00-4661	5/13/00			00-4755	5/21/00	10.25	W
99-5235	7/9/99	2.95	W	99-5310	8/5/99	7.29	W	00-4662	5/13/00	7.56	W	00-4756	5/21/00	9.68	W
99-5236	7/10/99	-7.71	Non W	99-5311	8/6/99	7.94	W	00-4663	5/13/00			00-4757	5/21/00	8.29	W
99-5237	7/10/99	7.66	W	99-5312	8/8/99	9.53	W	00-4664	5/15/00	7.05	W	00-4758	5/21/00	6.95	W
99-5238	7/10/99	4.43	W	99-5313	8/8/99	4.47	W	00-4665	5/15/00	9.75	W	00-4759	5/21/00	6.73	W
99-5239	7/10/99	3.33	W	99-5314	8/8/99	11.05	W	00-4666	5/15/00	7.34	W	00-4760	5/21/00	10.43	W
99-5240	7/12/99	5.07	W	99-5315	8/11/99	6.46	W	00-4667	5/15/00	4.16	W	00-4761	5/21/00	10.56	W
99-5241	7/12/99	3.50	W	99-5316	8/15/99			00-4668	5/15/00	6.88	W	00-4762	5/21/00	6.10	W
99-5242	7/12/99	3.84	W	99-5317	8/18/99	8.32	W	00-4669	5/15/00	8.64	W	00-4763	5/21/00	5.81	W
99-5243	7/12/99			99-5318	8/20/99	8.85	W	00-4670	5/15/00	8.86	W	00-4764	5/21/00	-8.11	Non W
99-5244	7/12/99			99-5319	8/21/99	-8.22	Non W	00-4671	5/15/00	11.33	W	00-4765	5/21/00	6.24	W
99-5245	7/12/99	8.60	W	99-5320	8/23/99	5.10	W	00-4672	5/15/00	3.48	W	00-4766	5/21/00	10.55	W
99-5246	7/12/99	6.19	W	99-5321	8/23/99			00-4673	5/15/00	3.55	W	00-4767	5/22/00	7.26	W
99-5247	7/12/99	6.38	W	99-5322	8/23/99	-7.87	Non W	00-4674	5/15/00	6.95	W	00-4768	5/22/00	7.64	W
99-5248	7/12/99	4.93	W	99-5323	8/26/99	-3.39	Non W	00-4675	5/15/00	5.02	W	00-4769	5/22/00	9.43	W
99-5249	7/12/99			00-4601	5/3/00	7.11	W	00-4676	5/15/00	10.52	W	00-4770	5/22/00	5.76	W
99-5250	7/12/99			00-4602	5/3/00	9.71	W	00-4677	5/15/00	7.90	W	00-4771	5/22/00		
99-5251	7/12/99	5.97	W	00-4603	5/3/00			00-4678	5/16/00	11.46	W	00-4772	5/22/00	8.68	W
99-5252	7/12/99	4.36	W	00-4604	5/3/00	-6.53	Non W	00-4679	5/16/00	6.40	W	00-4773	5/22/00	4.30	W
99-5253	7/12/99			00-4605	5/3/00	9.03	W	00-4680	5/16/00	2.12	W	00-4774	5/22/00		
99-5254	7/13/99	2.21	W	00-4606	5/3/00	9.03	W	00-4681	5/16/00			00-4775	5/22/00	9.18	W
99-5255	7/13/99	5.86	W	00-4607	5/3/00	4.52	W	00-4682	5/16/00	2.74	W	00-4776	5/22/00	1.94	W
99-5256	7/13/99	-3.10	Non W	00-4608	5/4/00	-1.98	Non W	00-4683	5/16/00	-4.18	Non W	00-4777	5/24/00	8.09	W
99-5257	7/13/99			00-4609	5/4/00	-3.41	Non W	00-4684	5/16/00	7.50	W	00-4778	5/24/00	10.58	W
99-5258	7/13/99	9.10	W	00-4610	5/6/00			00-4685	5/16/00	10.81	W	00-4779	5/24/00	8.39	W
99-5259	7/13/99	4.61	W	00-4611	5/6/00	-4.99	Non W	00-4686	5/16/00	7.89	W	00-4780	5/24/00	8.72	W
99-5260	7/15/99			00-4612	5/7/00	8.79	W	00-4687	5/16/00			00-4781	5/24/00	9.17	W
99-5261	7/15/99	9.46	W	00-4613	5/7/00	8.36	W	00-4688	5/16/00	1.33	Non W	00-4782	5/24/00	9.05	W
99-5262	7/15/99	-0.36	Non W	00-4614	5/7/00	6.41	W	00-4689	5/16/00	8.91	W	00-4783	5/24/00		
99-5263	7/15/99	6.02	W	00-4615	5/7/00	4.86	W	00-4690	5/16/00	4.92	W	00-4784	5/24/00	3.59	W
99-5264	7/15/99	5.69	W	00-4616	5/7/00	2.83	W	00-4691	5/16/00	6.21	W	00-4785	5/24/00	6.82	W
99-5265	7/15/99	6.55	W	00-4617	5/7/00	7.64	W	00-4692	5/16/00	4.27	W	00-4786	5/24/00	4.89	W
99-5266	7/16/99	8.12	W	00-4618	5/7/00	6.70	W	00-4693	5/18/00	8.59	W	00-4787	5/24/00	3.25	W
99-5267	7/18/99	7.32	W	00-4619	5/9/00	5.14	W	00-4694	5/18/00	4.85	W	00-4788	5/24/00	4.96	W
99-5268	7/18/99			00-4620	5/9/00	6.99	W	00-4695	5/18/00	7.92	W	00-4789	5/24/00	8.73	W
99-5269	7/18/99	3.30	W	00-4621	5/9/00			00-4696	5/18/00	5.89	W	00-4790	5/24/00	8.73	W
99-5270	7/18/99	4.61	W	00-4622	5/9/00	9.42	W	00-4697	5/18/00	5.93	W	00-4791	5/24/00	7.57	W
99-5271	7/18/99	7.83	W	00-4623	5/9/00	5.61	W	00-4698	5/18/00	3.59	W	00-4792	5/24/00	10.11	W
99-5272	7/18/99	9.13	W	00-4624	5/9/00	4.87	W	00-4699	5/18/00	1.77	W	00-4793	5/24/00	7.95	W
99-5273	7/19/99	5.29	W	00-4625	5/9/00	2.18	W	00-4700	5/18/00	6.29	W	00-4794	5/24/00	6.14	W
99-5274	7/19/99	3.22	W	00-4626	5/9/00	-6.96	Non W	00-4701	5/18/00	7.52	W	00-4795	5/24/00	6.26	W
99-5275	7/19/99			00-4627	5/9/00	4.87	W	00-4702	5/18/00	8.07	W	00-4796	5/24/00	1.38	W
99-5276	7/19/99	0.00	Non W	00-4628	5/9/00	5.49	W	00-4703	5/18/00	4.55	W	00-4797	5/24/00	8.73	W
99-5277	7/19/99	-0.01	Non W	00-4629	5/9/00	6.97	W	00-4704	5/18/00	6.25	W	00-4798	5/24/00	3.87	W
99-5278	7/19/99	3.27	W	00-4630	5/9/00	6.97	W	00-4705	5/18/00	4.95	W	00-4799	5/24/00	10.23	W

Appendix A. *continued*

ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1
00-4800	5/24/00	6.06	W	00-4875	5/30/00	5.98	W	00-5067	6/11/00	6.46	W	00-5323	6/24/00	9.17	W
00-4801	5/24/00	6.10	W	00-4876	5/30/00	3.44	W	00-5078	6/11/00	10.96	W	00-5326	6/24/00		
00-4802	5/24/00	8.30	W	00-4877	5/30/00	10.98	W	00-5081	6/11/00	5.21	W	00-5327	6/20/00	6.52	W
00-4803	5/24/00	10.52	W	00-4878	5/30/00	8.18	W	00-5082	6/11/00	3.57	W	00-5328	6/20/00	4.90	W
00-4804	5/24/00	3.35	W	00-4879	5/30/00	3.47	W	00-5083	6/11/00			00-5329	6/20/00	10.49	W
00-4805	5/24/00	6.61	W	00-4880	5/30/00	11.48	W	00-5084	6/11/00			00-5336	6/20/00	4.88	W
00-4806	5/24/00			00-4881	5/30/00			00-5085	6/11/00	10.89	W	00-5342	6/20/00	5.51	W
00-4807	5/24/00	4.86	W	00-4882	5/30/00			00-5086	6/11/00	11.11	W	00-5344	6/20/00	4.35	W
00-4808	5/24/00	5.76	W	00-4883	5/30/00			00-5090	6/11/00	7.17	W	00-5347	6/20/00	8.80	W
00-4809	5/25/00	7.16	W	00-4884	5/30/00			00-5091	6/11/00	6.36	W	00-5348	6/20/00	8.45	W
00-4810	5/25/00			00-4885	5/30/00	8.38	W	00-5099	6/11/00	10.14	W	00-5349	6/20/00	7.03	W
00-4811	5/25/00	6.79	W	00-4886	5/30/00			00-5100	6/11/00	6.90	W	00-5350	6/20/00		
00-4812	5/25/00	10.60	W	00-4887	5/30/00	11.81	W	00-5110	6/14/00	5.53	W	00-5352	6/20/00	2.91	W
00-4813	5/25/00	11.02	W	00-4888	5/30/00			00-5115	6/11/00	5.00	W	00-5353	6/20/00	11.78	W
00-4814	5/25/00	11.34	W	00-4889	5/30/00			00-5118	6/12/00	7.91	W	00-5354	6/20/00	2.54	W
00-4815	5/25/00			00-4890	5/30/00	8.07	W	00-5121	6/12/00		W	00-5365	6/20/00		
00-4816	5/25/00	7.64	W	00-4891	5/31/00	4.05	W	00-5122	6/12/00			00-5367	6/20/00	6.85	W
00-4817	5/25/00			00-4892	5/31/00	5.07	W	00-5125	6/12/00	7.27	W	00-5369	6/20/00	7.50	W
00-4818	5/25/00	7.04	W	00-4893	5/31/00	2.12	W	00-5133	6/14/00	4.66	W	00-5370	6/20/00	8.77	W
00-4819	5/25/00			00-4894	5/31/00	11.77	W	00-5136	6/14/00	6.11	W	00-5373	6/20/00		
00-4820	5/25/00			00-4895	5/31/00	9.65	W	00-5139	6/14/00	3.00	W	00-5375	6/20/00		
00-4821	5/25/00	6.45	W	00-4896	5/31/00	8.03	W	00-5140	6/14/00	6.27	W	00-5376	6/20/00	7.12	W
00-4822	5/25/00	9.73	W	00-4897	5/31/00	7.29	W	00-5141	6/14/00	9.42	W	00-5378	6/21/00	3.09	W
00-4823	5/25/00	9.28	W	00-4898	5/31/00	6.23	W	00-5142	6/14/00	6.73	W	00-5379	6/21/00	8.31	W
00-4824	5/25/00	10.62	W	00-4899	5/31/00	8.32	W	00-5149	6/14/00	4.66	W	00-5380	6/21/00	7.51	W
00-4825	5/27/00	4.69	W	00-4900	5/31/00	11.42	W	00-5152	6/14/00	6.95	W	00-5381	6/21/00	9.69	W
00-4826	5/27/00	9.19	W	00-4901	5/31/00	9.38	W	00-5159	6/14/00	5.07	W	00-5384	6/21/00	6.22	W
00-4827	5/27/00			00-4902	5/31/00	4.91	W	00-5161	6/15/00	10.07	W	00-5385	6/21/00	2.74	W
00-4828	5/27/00	10.06	W	00-4903	6/2/00	4.93	W	00-5163	6/15/00	2.66	W	00-5390	6/21/00		
00-4829	5/27/00	5.96	W	00-4905	6/2/00	9.93	W	00-5172	6/17/00	8.49	W	00-5392	6/21/00		
00-4830	5/27/00	5.23	W	00-4908	6/2/00	10.00	W	00-5176	6/17/00	5.63	W	00-5395	6/21/00	5.40	W
00-4831	5/27/00	7.34	W	00-4911	6/2/00	11.26	W	00-5177	6/17/00	9.25	W	00-5401	6/21/00	5.35	W
00-4832	5/27/00			00-4914	6/2/00	4.16	W	00-5179	6/17/00	7.39	W	00-5403	6/21/00		
00-4833	5/27/00	10.70	W	00-4916	6/2/00	11.69	W	00-5183	6/17/00	8.96	W	00-5408	6/23/00	6.39	W
00-4834	5/27/00	4.95	W	00-4917	6/2/00	6.84	W	00-5186	6/17/00	2.73	W	00-5417	6/23/00	7.17	W
00-4835	5/27/00	6.30	W	00-4941	6/2/00	4.46	W	00-5192	6/17/00	5.65	W	00-5421	6/23/00	6.21	W
00-4836	5/27/00	4.88	W	00-4944	6/2/00	5.44	W	00-5197	6/17/00	8.35	W	00-5425	6/23/00	9.95	W
00-4837	5/27/00			00-4946	6/3/00	-5.44	Non W	00-5199	6/17/00	3.78	W	00-5427	6/23/00	8.52	W
00-4838	5/27/00	6.96	W	00-4948	6/3/00	6.90	W	00-5202	6/18/00	5.06	W	00-5429	6/23/00	5.85	W
00-4839	5/27/00	10.32	W	00-4950	6/3/00	3.36	W	00-5205	6/18/00	7.31	W	00-5441	6/23/00	3.99	W
00-4840	5/27/00			00-4957	6/5/00			00-5213	6/20/00	9.13	W	00-5445	6/24/00		
00-4841	5/27/00	9.50	W	00-4959	6/5/00	4.89	W	00-5220	6/20/00	7.75	W	00-5447	6/24/00	6.67	W
00-4842	5/27/00	4.51	W	00-4961	6/5/00	9.53	W	00-5227	6/14/00	8.42	W	00-5448	6/24/00	2.76	W
00-4843	5/27/00	12.82	W	00-4962	6/5/00	7.81	W	00-5228	6/14/00	5.52	W	00-5450	6/24/00	10.06	W
00-4844	5/27/00	10.01	W	00-4965	6/5/00	3.38	W	00-5229	6/14/00	9.24	W	00-5454	6/24/00	7.73	W
00-4845	5/27/00	8.61	W	00-4968	6/5/00	4.09	W	00-5231	6/14/00			00-5457	6/26/00	6.07	W
00-4846	5/27/00	8.23	W	00-4971	6/5/00			00-5239	6/14/00	3.85	W	00-5463	6/26/00	7.48	W
00-4847	5/27/00			00-4972	6/5/00	11.18	W	00-5247	6/14/00	5.61	W	00-5466	6/26/00	8.91	W
00-4848	5/27/00	6.25	W	00-4974	6/6/00	9.25	W	00-5254	6/15/00	8.33	W	00-5467	6/26/00	10.44	W
00-4849	5/27/00			00-4978	6/6/00	6.53	W	00-5255	6/17/00	9.67	W	00-5471	6/27/00	7.33	W
00-4850	5/27/00	5.12	W	00-4983	6/6/00	6.47	W	00-5264	6/17/00	7.54	W	00-5475	6/29/00		
00-4851	5/27/00	6.25	W	00-4984	6/6/00	6.07	W	00-5266	6/17/00			00-5476	6/26/00	12.55	W
00-4852	5/28/00	6.84	W	00-4987	6/6/00	8.75	W	00-5268	6/17/00	4.15	W	00-5481	6/27/00	9.56	W
00-4853	5/28/00			00-4988	6/6/00	5.21	W	00-5269	6/17/00	1.29	W	00-5483	6/29/00		
00-4854	5/28/00	8.48	W	00-4994	6/6/00	7.22	W	00-5276	6/17/00	11.63	W	00-5484	6/29/00	5.84	W
00-4855	5/28/00	2.20	W	00-4995	6/8/00	5.01	W	00-5277	6/20/00			00-5488	6/29/00		
00-4856	5/28/00	5.58	W	00-5004	6/8/00			00-5278	6/20/00	4.26	W	00-5490	6/27/00	8.18	W
00-4857	5/28/00	8.52	W	00-5007	6/8/00	6.99	W	00-5280	6/20/00	7.11	W	00-5497	6/29/00	6.66	W
00-4858	5/28/00	8.05	W	00-5011	6/8/00	7.21	W	00-5281	6/20/00			00-5501	6/29/00	7.48	W
00-4859	5/28/00	7.67	W	00-5013	6/8/00	8.23	W	00-5282	6/20/00	7.94	W	00-5503	6/29/00	4.26	W
00-4860	5/28/00	6.54	W	00-5014	6/8/00	0.26	Non W	00-5283	6/20/00	9.80	W	00-5514	6/26/00	7.07	W
00-4861	5/28/00	7.32	W	00-5015	6/8/00			00-5284	6/20/00	9.56	W	00-5516	6/26/00	6.12	W
00-4862	5/28/00	4.76	W	00-5018	6/9/00	7.25	W	00-5287	6/20/00	9.32	W	00-5518	6/26/00	7.04	W
00-4863	5/28/00	10.82	W	00-5020	6/9/00	10.00	W	00-5291	6/20/00	4.96	W	00-5519	6/26/00	10.19	W
00-4864	5/30/00	6.48	W	00-5021	6/9/00	7.10	W	00-5293	6/20/00	8.85	W	00-5520	6/26/00	6.66	W
00-4865	5/30/00	5.71	W	00-5028	6/11/00	6.14	W	00-5297	6/20/00	4.30	W	00-5525	6/26/00		
00-4866	5/30/00	4.51	W	00-5033	6/11/00	10.24	W	00-5299	6/23/00	5.50	W	00-5532	6/26/00	6.38	W
00-4867	5/30/00	7.86	W	00-5035	6/11/00	4.18	W	00-5300	6/23/00	9.04	W	00-5533	6/26/00	6.48	W
00-4868	5/30/00	9.57	W	00-5038	6/11/00	3.90	W	00-5301	6/23/00	3.93	W	00-5537	6/26/00	5.94	W
00-4869	5/30/00			00-5044	6/11/00	9.36	W	00-5302	6/23/00	5.80	W	00-5543	6/26/00	8.78	W
00-4870	5/30/00	7.18	W	00-5045	6/11/00	6.32	W	00-5305	6/23/00	8.78	W	00-5545	6/26/00	3.82	W
00-4871	5/30/00	9.29	W	00-5047	6/11/00	11.56	W	00-5306	6/23/00	4.16	W	00-5546	6/26/00	8.99	W
00-4872	5/30/00	9.09	W	00-5056	6/11/00	3.32	W	00-5308	6/23/00	0.60	Non W	00-5547	6/26/00	4.87	W
00-4873	5/30/00	1.92	W	00-5065	6/11/00	5.39	W	00-5309	6/23/00	9.39	W	00-5552	6/26/00		
00-4874	5/30/00	7.30	W	00-5066	6/11/00	6.46	W	00-5315	6/23/00	6.26	W	00-5554	6/26/00	5.78	W

Appendix A. *continued*

ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1
00-5559	6/26/00	7.79	W	00-5938	7/5/00			00-6176	7/11/00	3.24	W	00-6447	8/7/00	-1.04	Non W
00-5564	6/26/00	5.85	W	00-5939	7/5/00			00-6177	7/11/00	5.26	W	00-6448	8/7/00		
00-5567	6/26/00	7.23	W	00-5942	7/5/00			00-6184	7/11/00	5.50	W	00-6449	8/7/00	8.56	W
00-5570	6/26/00	5.31	W	00-5944	7/5/00			00-6186	7/11/00	4.72	W	00-6450	8/10/00	8.96	W
00-5576	6/26/00	8.31	W	00-5951	7/5/00	3.95	W	00-6188	7/11/00	6.88	W	00-6451	8/10/00	8.04	W
00-5578	6/26/00	6.79	W	00-5960	7/6/00	8.45	W	00-6189	7/11/00	5.58	W	00-6452	8/10/00	8.63	W
00-5582	6/26/00			00-5963	7/6/00	8.37	W	00-6191	7/11/00	8.54	W	00-6453	8/10/00	-10.71	Non W
00-5587	6/26/00	1.34	W	00-5967	7/6/00	3.26	W	00-6193	7/11/00	8.14	W	00-6454	8/13/00	7.86	W
00-5593	6/26/00			00-5971	7/8/00	6.51	W	00-6197	7/14/00	6.12	W	00-6455	8/16/00	3.87	W
00-5594	6/26/00	4.40	W	00-5973	7/8/00	3.14	W	00-6201	7/14/00	8.66	W	00-6456	8/28/00	-7.71	Non W
00-5595	6/26/00	9.59	W	00-5975	7/8/00	7.85	W	00-6208	7/14/00	6.81	W				
00-5597	6/26/00	7.92	W	00-5983	7/8/00	12.07	W	00-6209	7/14/00	9.40	W				
00-5599	6/26/00	5.43	W	00-5985	7/8/00	7.20	W	00-6213	7/14/00	8.66	W				
00-5701	6/26/00	11.15	W	00-5990	7/8/00	5.22	W	00-6217	7/14/00	10.32	W				
00-5703	6/26/00	7.37	W	00-5993	7/8/00	8.14	W	00-6219	7/14/00	4.09	W				
00-5704	6/26/00	7.30	W	00-5995	7/8/00	6.87	W	00-6223	7/14/00	4.35	W				
00-5705	6/26/00	4.85	W	00-5998	7/8/00	10.60	W	00-6227	7/12/00	3.83	W				
00-5707	6/26/00			00-6002	7/8/00	6.09	W	00-6228	7/12/00	7.11	W				
00-5710	6/27/00	7.79	W	00-6003	7/8/00	3.63	W	00-6231	7/14/00	7.27	W				
00-5712	6/27/00	6.25	W	00-6004	7/8/00	6.01	W	00-6233	7/14/00	9.89	W				
00-5732	6/29/00	9.31	W	00-6006	7/8/00	6.32	W	00-6234	7/14/00	4.92	W				
00-5736	6/29/00	5.46	W	00-6007	7/8/00			00-6235	7/14/00	9.21	W				
00-5743	6/29/00	6.81	W	00-6012	7/8/00			00-6240	7/14/00	10.51	W				
00-5750	6/29/00			00-6015	7/8/00	5.69	W	00-6249	7/14/00	2.60	W				
00-5755	6/29/00	6.79	W	00-6016	7/8/00	6.02	W	00-6253	7/17/00	5.89	W				
00-5756	6/29/00	3.42	W	00-6017	7/8/00	11.05	W	00-6261	7/17/00	7.79	W				
00-5757	6/29/00	6.33	W	00-6020	7/8/00	8.27	W	00-6265	7/17/00	10.48	W				
00-5758	6/29/00	4.84	W	00-6023	7/8/00	-6.82	Non W	00-6269	7/18/00	4.42	W				
00-5759	6/29/00			00-6025	7/8/00			00-6270	7/18/00	4.01	W				
00-5762	6/29/00	4.26	W	00-6036	7/5/00	7.32	W	00-6273	7/18/00	3.33	W				
00-5769	6/30/00			00-6039	7/5/00	11.20	W	00-6275	7/20/00	7.18	W				
00-5773	6/30/00	8.85	W	00-6045	7/5/00			00-6294	7/26/00	3.32	W				
00-5775	6/30/00	3.41	W	00-6049	7/5/00	8.93	W	00-6297	7/26/00	9.26	W				
00-5776	6/30/00			00-6055	7/5/00	8.54	W	00-6300	7/29/00	8.43	W				
00-5777	6/30/00	10.06	W	00-6056	7/5/00	8.17	W	00-6301	7/29/00	3.99	W				
00-5778	6/30/00	8.26	W	00-6057	7/5/00			00-6302	8/2/00						
00-5780	6/30/00			00-6074	7/8/00	6.14	W	00-6303	8/4/00	2.51	W				
00-5787	7/2/00	3.81	W	00-6076	7/8/00	9.08	W	00-6304	8/4/00	5.05	W				
00-5789	7/2/00	7.11	W	00-6084	7/8/00	4.71	W	00-6306	8/5/00	2.22	W				
00-5804	7/2/00			00-6085	7/8/00	9.14	W	00-6325	8/1/00	7.42	W				
00-5806	7/2/00			00-6087	7/8/00	4.84	W	00-6326	8/1/00						
00-5817	7/2/00	5.35	W	00-6088	7/8/00	10.20	W	00-6340	7/17/00	7.65	W				
00-5818	7/2/00	4.24	W	00-6089	7/8/00	7.27	W	00-6349	7/17/00						
00-5820	7/2/00			00-6095	7/12/00			00-6352	7/17/00	7.83	W				
00-5823	7/2/00	6.52	W	00-6098	7/12/00			00-6354	7/17/00	4.16	W				
00-5824	7/2/00	8.24	W	00-6099	7/12/00	6.22	W	00-6356	7/17/00	5.15	W				
00-5834	7/2/00	0.31	Non W	00-6100	7/12/00			00-6357	7/17/00	9.94	W				
00-5835	7/2/00			00-6101	7/12/00	5.66	W	00-6359	7/17/00		W				
00-5836	7/2/00			00-6103	7/12/00	3.84	W	00-6362	7/17/00	7.49	W				
00-5842	7/2/00	2.98	W	00-6104	7/12/00	11.03	W	00-6370	7/18/00	9.16	W				
00-5843	7/2/00			00-6105	7/12/00	4.28	W	00-6372	7/20/00						
00-5846	7/2/00	5.89	W	00-6112	7/11/00	2.40	W	00-6375	7/20/00						
00-5855	7/2/00	5.47	W	00-6117	7/11/00			00-6378	7/20/00	6.69	W				
00-5861	7/2/00	2.58	W	00-6118	7/11/00	9.29	W	00-6380	7/20/00						
00-5863	7/2/00	5.94	W	00-6119	7/11/00			00-6382	7/20/00	5.10	W				
00-5864	7/2/00	6.22	W	00-6120	7/11/00	7.74	W	00-6383	7/20/00						
00-5870	7/2/00			00-6123	7/11/00			00-6384	7/20/00	3.63	W				
00-5872	7/2/00			00-6125	7/11/00	8.38	W	00-6386	7/20/00	6.77	W				
00-5874	7/2/00	6.67	W	00-6127	7/8/00	4.92	W	00-6389	7/20/00	10.08	W				
00-5876	7/2/00	5.30	W	00-6130	7/8/00	9.45	W	00-6392	7/20/00	3.48	W				
00-5877	7/2/00	9.22	W	00-6132	7/9/00	6.61	W	00-6396	7/20/00	6.21	W				
00-5880	7/2/00			00-6133	7/9/00			00-6401	7/20/00	5.67	W				
00-5882	7/2/00			00-6138	7/9/00	7.69	W	00-6412	7/23/00	9.62	W				
00-5890	7/3/00			00-6139	7/9/00	8.94	W	00-6417	7/23/00	8.57	W				
00-5891	7/3/00	7.77	W	00-6141	7/9/00	4.97	W	00-6420	7/23/00	8.01	W				
00-5893	7/3/00			00-6143	7/9/00	9.18	W	00-6423	7/24/00	5.89	W				
00-5895	7/3/00	10.21	W	00-6155	7/11/00	4.67	W	00-6424	7/24/00						
00-5896	7/3/00	7.71	W	00-6162	7/11/00	6.03	W	00-6426	7/26/00	8.78	W				
00-5908	7/5/00	9.14	W	00-6164	7/11/00			00-6427	7/26/00	3.25	W				
00-5920	7/5/00	8.11	W	00-6165	7/11/00	9.59	W	00-6440	8/1/00	5.12	W				
00-5923	7/5/00	6.18	W	00-6167	7/11/00	4.25	W	00-6441	8/1/00	8.11	W				
00-5924	7/5/00	8.53	W	00-6170	7/11/00			00-6442	8/4/00	6.22	W				
00-5929	7/5/00	1.92	W	00-6171	7/11/00	6.59	W	00-6443	8/4/00	3.50	W				
00-5930	7/5/00			00-6173	7/11/00			00-6444	8/5/00						
00-5932	7/5/00			00-6175	7/11/00			00-6445	8/5/00	7.09	W				

Appendix B. Juvenile samples collected from Red Bluff Diversion Dam, 1995-2000. Samples without LOD score or winter / non-winter run call had insufficient data for WHICHRUN analysis.

ID	COL DATE	LOD	LOD>1
95-0381	8/4/95		
95-0382	8/24/95	7.53	W
95-0383	8/25/95	7.89	W
95-0384	8/30/95	6.98	W
95-0385	8/30/95	####	W
95-0386	8/30/95	2.62	W
95-0387	8/29/95	6.78	W
95-0388	8/29/95	8.28	W
95-0389	8/29/95	4.02	W
95-0390	9/12/95	7.89	W
95-0391	9/15/95	3.01	W
95-0392	9/15/95	8.39	W
95-0393	9/19/95	4.39	W
95-0394	9/22/95	6.65	W
95-0395	9/22/95	5.33	W
95-0396	9/22/95	6.20	W
95-0397	9/22/95	8.73	W
95-0398	9/22/95	####	W
95-0399	9/22/95	7.46	W
95-0400	9/22/95	5.30	W
95-0401	9/22/95	6.56	W
95-0402	9/22/95	4.84	W
95-0403	9/22/95	5.17	W
95-0404	9/26/95	8.05	W
95-0405	9/26/95	5.61	W
95-0406	9/26/95	4.03	W
95-0407	9/26/95	3.07	W
95-0408	9/26/95	4.89	W
95-0409	9/26/95	7.19	W
95-0410	9/26/95		
95-0411	9/26/95	9.49	W
95-0412	9/26/95	2.77	W
95-0413	9/26/95		
95-0414	9/29/95		
95-0415	9/29/95	####	W
95-0416	9/29/95	4.56	W
95-0417	9/29/95	6.46	W
95-0418	9/29/95	6.62	W
95-0419	9/29/95	####	Non W
95-0420	9/29/95	3.02	W
95-0421	9/29/95	5.23	W
95-0425	1/5/95	Jan or typo?	
95-0430	10/11/95	####	W
95-0431	10/11/95		
95-0432	10/11/95	4.78	W
95-0433	10/11/95	4.40	W
95-0434	10/11/95	4.64	W
95-0435	10/11/95	6.36	W
95-0436	10/11/95	8.44	W
95-0437	10/11/95	####	W
95-0438	10/11/95	5.22	W
95-0439	10/3/95	6.11	W
95-0440	10/3/95	6.77	W
95-0441	10/3/95		
95-0442	10/3/95	5.30	W
95-0443	10/3/95	7.76	W
95-0444	10/3/95	####	W
95-0445	10/3/95	3.04	W
95-0446	10/3/95	3.30	W
95-0447	10/3/95	2.55	W
95-0448	9/27/95	6.92	W
95-0472	10/3/95		
95-0473	10/3/95	9.73	W
95-0474	10/4/95	4.72	W
95-0475	10/4/95	8.01	W
95-0476	10/4/95	5.90	W
95-0483	10/18/95	7.45	W
95-0484	10/18/95	3.92	W
95-0485	10/18/95	3.82	W
95-0486	10/18/95	####	W
95-0487	10/18/95	6.25	W
95-0488	10/18/95	####	W
95-0489	10/18/95	8.14	W
95-0490	10/18/95	6.28	W

ID	COL DATE	LOD	LOD>1
95-0491	10/25/95	6.74	W
95-0492	10/25/95		
95-0493	10/25/95	3.54	W
95-0494	10/25/95	8.36	W
95-0495	10/25/95	4.45	W
95-0496	10/25/95	6.42	W
95-0497	11/1/95	2.05	W
95-0498	11/1/95	9.13	W
95-0539	11/1/95	####	W
95-0540	11/1/95	6.50	W
95-0541	11/1/95		
95-0542	11/1/95	7.56	W
95-0543	11/1/95	9.96	W
95-0544	11/1/95	3.69	W
95-0545	11/1/95	6.74	W
95-0546	11/8/95	6.50	W
95-0547	11/8/95	2.58	W
95-0548	11/8/95	4.08	W
95-0549	11/8/95	6.27	W
95-0550	11/8/95	3.95	W
95-0551	11/8/95	3.70	W
95-0552	11/8/95	7.19	W
95-0553	11/21/95	5.31	W
95-0554	11/21/95	8.17	W
95-0555	11/21/95	4.08	W
95-0556	11/21/95	6.51	W
95-0557	11/21/95	####	W
95-0558	11/21/95	5.70	W
95-0559	11/21/95	5.65	W
95-0560	11/28/95		
95-0561	11/28/95	9.97	W
95-0562	11/28/95	5.30	W
95-0563	11/28/95	4.91	W
95-0564	11/28/95	8.92	W
95-0565	11/28/95	8.25	W
95-0566	11/28/95	8.36	W
95-0568	12/5/95	8.34	W
95-0569	12/5/95	####	W
95-0570	12/5/95	0.80	Non W
95-0571	12/5/95	5.22	W
96-3000	7/31/96	7.12	W
96-3001	7/31/96	####	Non W
96-3002	8/1/96		
96-3003	8/1/96	7.12	W
96-3004	8/6/96	5.42	W
96-3005	8/6/96	2.29	W
96-3006	8/6/96	6.84	W
96-3007	8/7/96		
96-3008	8/7/96	3.79	W
96-3009	8/2/96	2.88	W
96-3010	8/2/96	####	Non W
96-3011	8/13/96	####	Non W
96-3012	8/13/96	4.93	W
96-3013	8/13/96	####	W
96-3014	8/13/96	0.43	Non W
96-3015	8/13/96	9.08	W
96-3016	8/20/96	4.66	W
96-3017	8/20/96	5.47	W
96-3018	8/20/96	3.53	W
96-3019	8/20/96		
96-3020	8/20/96	5.82	W
96-3026	8/27/96	6.82	W
96-3027	8/27/96	4.81	W
96-3028	8/27/96	7.41	W
96-3029	8/27/96	4.92	W
96-3030	8/27/96	4.84	W
96-3031	9/3/96	4.87	W
96-3032	9/3/96	3.72	W
96-3033	9/3/96	8.80	W
96-3034	9/3/96		
96-3035	9/3/96	8.33	W
96-3040	9/10/96		
96-3041	9/10/96		

ID	COL DATE	LOD	LOD>1
96-3042	9/10/96		
96-3043	9/10/96	7.42	W
96-3044	9/10/96		
96-3046	9/17/96	0.02	Non W
96-3047	9/17/96		
96-3048	9/17/96	7.96	W
96-3049	9/17/96		
96-3050	9/17/96	4.43	W
96-3067	9/25/96		
96-3068	9/25/96		
96-3069	9/25/96	4.33	W
96-3070	9/25/96	4.63	W
96-3071	9/25/96	8.36	W
96-3074	10/1/96	4.97	W
96-3075	10/1/96	1.10	W
96-3076	10/1/96	8.70	W
96-3077	10/1/96		
96-3078	10/1/96	5.30	W
96-3080	10/8/96		
96-3081	10/8/96	5.12	W
96-3082	10/8/96	5.87	W
96-3083	10/8/96	####	Non W
96-3085	10/9/96		
96-3100	10/15/96	3.07	W
96-3101	10/15/96	5.10	W
96-3102	10/15/96	7.55	W
96-3103	10/15/96		
96-3104	10/15/96	7.31	W
96-3113	10/22/96		
96-3114	10/23/96	1.88	W
96-3115	10/23/96	2.50	W
96-3116	10/23/96		
96-3117	10/23/96	6.84	W
96-3121	10/30/96	4.65	W
96-3122	10/30/96		
96-3123	10/30/96	5.12	W
96-3124	10/30/96		
96-3125	10/30/96	2.85	W
96-3126	11/5/96	4.87	W
96-3127	11/5/96	1.76	W
96-3128	11/5/96	6.80	W
96-3129	11/5/96	####	W
96-3130	11/6/96	0.71	Non W
96-3131	11/12/96	4.83	W
96-3134	11/12/96		
96-3136	11/13/96		
96-3137	11/13/96		
96-3138	11/14/96		
96-3139	11/18/96		
96-3140	11/18/96		
96-3141	11/18/96		
96-3142	11/18/96	6.06	W
96-3143	11/18/96	7.00	W
96-3159	11/26/96		
96-3160	11/26/96		
96-3161	11/26/96		
96-3162	11/26/96	0.59	Non W
96-3163	11/26/96	4.63	W
96-3164	12/4/96	9.56	W
96-3165	12/5/96	####	W
96-3166	12/5/96	7.43	W
96-3167	12/5/96	3.48	W
96-3168	12/5/96		
96-3169	12/9/96	3.06	W
96-3170	12/9/96		
96-3171	12/9/96	2.14	W
96-3172	12/9/96	4.60	W
97-3107	8/5/97	7.75	W
97-3108	8/5/97		
97-3109	8/5/97	6.21	W
97-3111	8/6/97	7.60	W
97-3112	8/7/97	3.41	W
97-3113	8/8/97	####	Non W

ID	COL DATE	LOD	LOD>1
97-3114	8/8/97	8.36	W
97-3115	8/8/97	6.33	W
97-3116	8/8/97	4.08	W
97-3117	8/8/97	0.27	Non W
97-3118	8/8/97	3.08	W
97-3119	8/12/97	7.48	W
97-3120	8/14/97	5.57	W
97-3121	8/14/97	5.63	W
97-3122	8/15/97	9.56	W
97-3201	7/24/97	Steelhead	
97-3202	7/24/97	####	Non W
97-3203	7/24/97	9.75	W
97-3204	7/25/97	4.54	W
97-3205	7/25/97	4.43	W
97-3206	7/25/97	0.36	Non W
97-3207	7/29/97		
97-3208	7/30/97	0.94	Non W
97-3209	7/30/97	0.64	Non W
97-3210	7/31/97	####	W
97-3211	7/31/97	7.13	W
97-3212	7/31/97	6.11	W
97-3213	8/1/97	6.01	W
97-3214	8/1/97	7.19	W
97-3215	8/1/97	1.31	W
97-3216	8/1/97	8.43	W
97-3217	8/1/97	####	W
97-3218	8/20/97	5.56	W
97-3222	8/22/97	0.62	Non W
97-3223	8/22/97	7.61	W
97-3224	8/27/97	####	W
97-3225	8/27/97	7.75	W
97-3226	8/27/97	7.10	W
97-3227	8/27/97	no sample	
97-3228	8/27/97	####	W
97-3229	8/27/97	7.91	W
97-3232	8/27/97	6.44	W
97-3233	8/27/97	8.15	W
97-3234	8/15/97	4.98	W
97-3235	8/15/97	9.35	W
97-3236	8/15/97		
97-3337	8/28/97	6.19	W
97-3338	8/29/97	9.98	W
97-3339	8/29/97	8.32	W
97-3340	8/29/97	1.98	W
97-3341	8/29/97	8.79	W
97-3342	9/3/97	5.43	W
97-3343	9/3/97	5.79	W
97-3344	9/3/97	7.33	W
97-3345	9/3/97	####	W
97-3346	9/3/97	6.83	W
97-3347	9/3/97	1.57	W
97-3348	9/3/97	8.06	W
97-3349	9/3/97	8.41	W
97-3350	9/3/97	6.98	W
97-3351	9/3/97	6.43	W
97-3352	9/3/97	3.97	W
97-3353	9/3/97	8.72	W
97-3354	9/3/97	####	W
97-3355	9/3/97	3.07	W
97-3356	9/3/97	5.57	W
97-3357	9/3/97	8.13	W
97-3358	9/3/97	7.54	W
97-3359	9/3/97	7.09	W
97-3360	9/3/97	8.85	W
97-3361	9/3/97	6.79	W
97-3362	9/3/97	6.37	W
97-3363	9/3/97	8.19	W
97-3364	9/3/97	4.55	W
97-3365	9/3/97	5.37	W
97-3366	9/3/97	7.54	W
97-3367	9/3/97		
97-3368	9/4/97	7.97	W
97-3369	9/4/97	6.49	W
97-3370	9/4/97	3.73	W

Appendix B. *continued*

ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1
97-337	9/4/97	####	W	97-344	9/9/97	5.93	W	97-352	9/16/97	5.09	W	97-360	10/3/97	6.49	W
97-337	9/4/97	####	W	97-344	9/9/97	8.98	W	97-352	9/16/97	8.80	W	97-360	10/3/97		
97-337	9/4/97	9.97	W	97-344	9/9/97	10.79	W	97-352	9/16/97	7.99	W	97-360	10/7/97	3.65	W
97-337	9/4/97	####	W	97-344	9/9/97	10.41	W	97-352	9/16/97			97-360	10/9/97	9.81	W
97-337	9/4/97	6.48	W	97-344	9/9/97	5.34	W	97-352	9/16/97	4.21	W	97-360	10/9/97	8.12	W
97-337	9/4/97	8.53	W	97-345	9/9/97	5.81	W	97-352	9/16/97	9.63	W	97-361	10/9/97	7.68	W
97-337	9/4/97	9.85	W	97-345	9/10/97	9.02	W	97-352	9/16/97	5.90	W	97-361	10/9/97	7.07	W
97-337	9/4/97	2.96	W	97-345	9/10/97	9.32	W	97-352	9/16/97	9.01	W	97-361	10/10/97		
97-337	9/4/97	-0.15	Non W	97-345	9/10/97	8.44	W	97-353	9/16/97	5.67	W	97-361	10/10/97	6.89	W
97-338	9/4/97	4.21	W	97-345	9/10/97	6.87	W	97-353	9/16/97	9.03	W	97-361	10/10/97	2.02	W
97-338	9/4/97	8.12	W	97-345	9/10/97	7.93	W	97-353	9/16/97	4.59	W	97-361	10/10/97	3.77	W
97-338	9/4/97	9.19	W	97-345	9/10/97			97-353	9/23/97	5.07	W	97-361	10/10/97		
97-338	9/4/97	3.10	W	97-345	9/10/97	2.74	W	97-353	9/23/97	10.44	W	97-361	10/10/97	8.16	W
97-338	9/4/97	####	W	97-346	9/11/97	6.77	W	97-354	9/23/97	6.52	W	97-361	10/24/97	8.92	W
97-338	9/4/97	####	W	97-346	9/11/97	8.95	W	97-354	9/23/97			97-362	10/24/97		
97-338	9/4/97	5.54	W	97-346	9/11/97	7.53	W	97-354	9/23/97			97-362	10/24/97		
97-338	9/4/97	####	W	97-346	9/11/97	3.55	W	97-354	9/23/97	6.20	W	97-362	10/29/97		
97-338	9/4/97	6.06	W	97-346	9/11/97	6.50	W	97-354	9/23/97	8.56	W	97-362	10/30/97	2.73	W
97-338	9/4/97	4.11	W	97-346	9/11/97	6.57	W	97-354	9/23/97	6.42	W	97-362	11/4/97	5.38	W
97-339	9/4/97	8.62	W	97-346	9/11/97	4.55	W	97-354	9/23/97	7.26	W	97-362	11/6/97		
97-339	9/4/97	8.86	W	97-346	9/11/97	6.76	W	97-354	9/23/97	9.36	W	97-362	11/11/97		
97-339	9/4/97	9.83	W	97-346	9/11/97	7.59	W	97-355	9/23/97	9.24	W	97-362	11/12/97		
97-339	9/4/97	9.79	W	97-346	9/11/97	5.02	W	97-355	9/24/97	8.33	W	97-362	11/13/97		
97-339	9/4/97	9.38	W	97-347	9/11/97			97-355	9/24/97	10.90	W	97-362	11/13/97		
97-339	9/4/97	6.66	W	97-347	9/11/97	9.11	W	97-355	9/24/97	7.05	W	97-363	11/18/97		
97-339	9/4/97	6.08	W	97-347	9/11/97	8.36	W	97-355	9/24/97	9.30	W	97-363	11/18/97		
97-339	9/4/97	2.36	W	97-347	9/11/97	11.00	W	97-355	9/24/97	8.63	W	97-363	11/18/97		
97-339	9/4/97	7.16	W	97-347	9/11/97	7.72	W	97-355	9/24/97	8.00	W	97-363	11/18/97		
97-339	9/4/97	8.29	W	97-347	9/11/97	8.85	W	97-355	9/24/97	4.00	W	97-363	11/18/97		
97-340	9/4/97	6.31	W	97-347	9/11/97	7.31	W	97-355	9/24/97	5.16	W	97-363	11/18/97		
97-340	9/4/97	8.68	W	97-347	9/11/97	3.16	W	97-355	9/24/97	7.38	W	97-363	11/18/97		
97-340	9/4/97	5.02	W	97-347	9/11/97	8.52	W	97-356	9/24/97	5.63	W	97-363	11/18/97		
97-340	9/4/97	9.56	W	97-347	9/11/97	8.94	W	97-356	9/24/97	3.76	W	97-363	11/18/97		
97-340	9/4/97	8.98	W	97-348	9/11/97	7.38	W	97-356	9/24/97	8.47	W	97-363	11/18/97		
97-340	9/4/97	####	W	97-348	9/11/97	8.00	W	97-356	9/26/97	9.25	W	97-364	11/18/97		
97-340	9/4/97	9.24	W	97-348	9/11/97	7.48	W	97-356	9/26/97	7.44	W	97-364	11/18/97		
97-340	9/4/97	8.92	W	97-348	9/11/97	6.35	W	97-356	9/26/97	4.59	W	97-364	11/18/97		
97-340	9/4/97	8.56	W	97-348	9/11/97	6.48	W	97-356	9/26/97	5.78	W	97-364	11/18/97		
97-340	9/4/97	5.31	W	97-348	9/12/97	6.59	W	97-356	9/26/97	8.89	W	97-364	11/18/97		
97-341	9/4/97	1.30	W	97-348	9/12/97	5.30	W	97-356	9/26/97	2.17	W	97-364	11/18/97		
97-341	9/4/97	4.47	W	97-348	9/12/97	5.54	W	97-356	9/26/97	8.37	W	97-364	11/18/97		
97-341	9/4/97	4.34	W	97-348	9/12/97	8.24	W	97-357	9/26/97	4.47	W	97-364	11/18/97		
97-341	9/4/97			97-349	9/12/97	9.84	W	97-357	9/26/97	6.86	W	97-364	11/18/97		
97-341	9/4/97	5.24	W	97-349	9/12/97	8.99	W	97-357	9/26/97	4.18	W	97-365	11/18/97		
97-341	9/4/97	7.83	W	97-349	9/12/97	5.83	W	97-357	9/26/97	9.19	W	97-365	11/18/97		
97-341	9/4/97	8.16	W	97-349	9/12/97	9.17	W	97-357	9/26/97	5.87	W	97-365	11/18/97		
97-341	9/4/97	7.71	W	97-349	9/12/97	5.01	W	97-357	9/26/97	10.18	W	97-365	11/18/97		
97-341	9/4/97	2.91	W	97-349	9/12/97	4.35	W	97-357	9/26/97	9.73	W	97-365	11/18/97		
97-341	9/4/97			97-349	9/12/97	8.74	W	97-357	9/26/97	5.07	W	97-365	11/18/97		
97-342	9/4/97			97-349	9/12/97	7.89	W	97-357	9/26/97	11.08	W	97-365	11/18/97		
97-342	9/4/97			97-349	9/12/97	7.38	W	97-357	9/26/97	5.21	W	97-365	11/18/97		
97-342	9/4/97	6.86	W	97-349	9/12/97			97-358	9/26/97	7.05	W	97-365	11/18/97		
97-342	9/4/97	4.75	W	97-350	9/16/97	8.33	W	97-358	9/26/97	12.07	W	97-365	11/18/97		
97-342	9/4/97	4.40	W	97-350	9/16/97	7.69	W	97-358	9/26/97	6.00	W	97-366	11/18/97		
97-342	9/4/97	7.50	W	97-350	9/16/97	8.61	W	97-358	9/26/97	11.80	W	97-366	11/18/97		
97-342	9/4/97	5.84	W	97-350	9/16/97	2.37	W	97-358	9/26/97	10.09	W	97-366	11/18/97		
97-342	9/4/97	3.74	W	97-350	9/16/97			97-358	9/26/97	7.57	W	97-366	11/18/97		
97-342	9/4/97	8.47	W	97-350	9/16/97	6.86	W	97-358	9/26/97	4.39	W	97-366	11/18/97		
97-342	9/4/97	7.06	W	97-350	9/16/97	1.76	W	97-358	9/26/97	11.51	W	97-366	11/18/97		
97-343	9/4/97	####	W	97-350	9/16/97	11.46	W	97-358	9/26/97	7.31	W	97-366	11/18/97	7.73	W
97-343	9/4/97	####	W	97-350	9/16/97	4.47	W	97-359	9/26/97	9.17	W	97-366	11/18/97	2.47	W
97-343	9/4/97	6.87	W	97-350	9/16/97			97-359	9/26/97	10.74	W	97-366	11/18/97	6.67	W
97-343	9/4/97			97-351	9/16/97	4.63	W	97-359	9/26/97	8.58	W	97-366	11/18/97	4.14	W
97-343	9/4/97			97-351	9/16/97	7.89	W	97-359	9/26/97	7.31	W	97-367	11/18/97	10.74	W
97-343	9/4/97	8.28	W	97-351	9/16/97	8.47	W	97-359	9/26/97	4.35	W	97-367	11/18/97	7.98	W
97-343	9/4/97			97-351	9/16/97	9.10	W	97-359	9/30/97	6.19	W	97-367	11/18/97	9.78	W
97-343	9/4/97	5.18	W	97-351	9/16/97	9.11	W	97-359	10/1/97	7.61	W	97-367	11/18/97	2.43	W
97-343	9/4/97	7.28	W	97-351	9/16/97	5.75	W	97-359	10/1/97	9.87	W	97-367	11/20/97	7.08	W
97-343	9/4/97	1.99	W	97-351	9/16/97	8.84	W	97-359	10/1/97	10.88	W	97-367	11/25/97	-0.93	Non W
97-344	9/4/97	5.78	W	97-351	9/16/97	6.96	W	97-360	10/1/97	7.31	W	97-367	11/25/97	9.82	W
97-344	9/4/97			97-351	9/16/97	6.26	W	97-360	10/1/97	8.25	W	97-367	11/25/97	3.75	W
97-344	9/4/97	####	W	97-351	9/16/97	7.44	W	97-360	10/3/97	9.62	W	97-367	11/25/97	2.23	W
97-344	9/4/97	6.60	W	97-352	9/16/97	7.12	W	97-360	10/3/97	8.45	W	97-367	11/25/97	8.99	W
97-344	9/9/97	9.89	W	97-352	9/16/97	6.93	W	97-360	10/3/97	8.89	W	97-368	11/25/97	6.86	W

Appendix B. *continued*

ID	COL DATE	LOD	LOD>1
97-368	11/25/97	8.62	W
97-368	11/26/97	5.34	W
97-368	11/26/97	3.83	W
97-368	11/26/97	9.72	W
98-615	7/17/98	6.25	W
98-615	7/17/98	9.83	W
98-615	7/17/98	7.55	W
98-615	7/16/98	3.04	W
98-615	7/16/98	5.19	W
98-615	7/21/98	6.60	W
98-615	7/21/98	11.65	W
98-616	7/21/98	-0.16	Non W
98-616	7/21/98	4.67	W
98-616	7/22/98	8.17	W
98-616	7/22/98	6.02	W
98-616	7/22/98	7.94	W
98-616	7/22/98	3.45	W
98-616	7/22/98	2.63	W
98-616	7/22/98	11.49	W
98-616	7/23/98	7.05	W
98-616	7/23/98	3.37	W
98-617	7/23/98	1.72	W
98-617	7/23/98	3.91	W
98-617	7/23/98	0.34	Non W
98-617	7/23/98	5.14	W
98-617	7/23/98	-4.66	Non W
98-617	7/23/98	0.70	Non W
98-617	7/23/98	8.68	W
98-617	7/23/98	5.73	W
98-617	7/23/98	12.16	W
98-617	7/23/98	8.62	W
98-618	7/23/98	7.64	W
98-618	7/23/98	9.86	W
98-618	7/24/98	7.47	W
98-618	7/24/98	6.55	W
98-618	7/24/98	6.10	W
98-618	7/24/98	1.67	W
98-618	7/24/98	7.41	W
98-618	7/24/98	3.09	W
98-618	7/24/98	9.27	W
98-618	7/24/98	1.69	W
98-619	7/24/98	7.70	W
98-619	7/24/98	10.27	W
98-619	7/24/98	3.98	W
98-619	7/24/98	3.75	W
98-619	7/24/98	9.16	W
98-619	7/24/98	8.92	W
98-619	8/4/98	9.86	W
98-619	8/6/98	8.26	W
98-619	7/28/98	8.50	W
98-619	7/28/98	7.55	W
98-620	7/28/98	3.88	W
98-620	7/28/98	6.55	W
98-620	7/28/98	6.98	W
98-620	7/28/98	5.35	W
98-620	7/28/98	5.20	W
98-620	7/29/98	8.58	W
98-620	7/29/98	8.92	W
98-620	7/29/98	6.30	W
98-620	7/29/98	2.81	W
98-620	7/29/98	3.95	W
98-621	7/29/98	8.23	W
98-621	7/29/98	5.32	W
98-621	7/29/98	9.54	W
98-621	7/29/98	8.20	W
98-621	7/29/98	6.70	W
98-621	7/29/98	3.26	W
98-621	7/29/98	2.79	W
98-621	7/29/98	7.79	W
98-621	7/29/98	5.29	W
98-621	7/29/98	6.81	W
98-622	7/29/98	8.35	W
98-622	7/29/98	10.22	W

ID	COL DATE	LOD	LOD>1
98-622	7/31/98	7.61	W
98-622	8/7/98	-1.79	Non W
98-622	8/7/98	8.53	W
98-622	8/7/98	4.46	W
98-622	8/11/98	4.82	W
98-622	8/11/98	6.40	W
98-622	8/12/98	7.35	W
98-622	8/12/98		
98-623	8/12/98	0.78	Non W
98-623	8/12/98	7.78	W
98-623	8/13/98	4.21	W
98-623	8/13/98	2.59	W
98-623	8/13/98	9.48	W
98-623	8/14/98	9.74	W
98-623	8/14/98	10.00	W
98-623	8/14/98	8.76	W
98-623	8/14/98	10.25	W
98-623	8/18/98	6.87	W
98-624	8/18/98	8.30	W
98-624	8/18/98	1.78	W
98-624	8/19/98	2.18	W
98-624	8/19/98	7.20	W
98-624	8/19/98	10.48	W
98-624	8/19/98	4.41	W
98-624	8/19/98	7.76	W
98-624	8/19/98	11.42	W
98-624	8/25/98	7.58	W
98-624	9/1/98	4.91	W
98-625	9/4/98	8.26	W
98-625	9/4/98	5.49	W
98-625	9/10/98	7.90	W
98-625	9/11/98	4.14	W
98-625	9/11/98	7.63	W
98-625	9/15/98	4.48	W
98-625	9/15/98	2.62	W
98-625	9/15/98	8.33	W
98-625	9/15/98	3.98	W
98-625	9/15/98	7.12	W
98-626	9/15/98	7.84	W
98-626	9/15/98	7.28	W
98-626	9/15/98	9.26	W
98-626	9/15/98	10.03	W
98-626	9/15/98	4.54	W
98-626	9/15/98	-0.25	Non W
98-626	9/15/98	0.31	Non W
98-626	9/15/98	7.98	W
98-626	9/15/98	2.94	W
98-626	9/15/98	6.03	W
98-627	9/21/98	7.44	W
98-627	9/22/98	5.23	W
98-627	9/23/98	6.98	W
98-627	9/23/98	6.73	W
98-627	9/23/98	2.74	W
98-627	9/23/98	3.82	W
98-627	9/23/98	7.63	W
98-627	9/24/98	8.70	W
98-627	9/28/98	4.16	W
98-628	9/28/98	5.33	W
98-628	9/10/98	7.62	W
98-628	9/28/98	6.00	W
98-628	9/28/98	8.23	W
98-628	9/29/98	9.00	W
98-628	9/29/98	7.06	W
98-628	9/29/98	10.42	W
98-628	10/1/98	9.12	W
98-628	10/2/98	3.34	W
98-629	10/6/98	2.75	W
98-629	10/7/98	5.50	W
98-629	10/8/98	3.11	W
98-629	10/8/98	6.66	W
98-629	10/8/98	7.38	W
98-629	10/22/98	6.84	W
98-629	10/23/98	3.40	W
98-629	10/24/98		

ID	COL DATE	LOD	LOD>1
98-629	10/24/98	10.49	W
98-630	10/24/98	8.84	W
98-630	10/24/98	5.94	W
98-630	10/24/98	8.53	W
98-630	10/24/98	10.55	W
98-630	10/24/98	9.01	W
98-630	10/24/98	6.65	W
98-630	10/26/98	2.31	W
98-630	10/29/98		
98-630	10/29/98	7.13	W
98-631	10/30/98	4.60	W
98-631	10/30/98	8.47	W
98-631	10/30/98		
98-631	10/30/98	3.56	W
98-631	10/30/98	2.91	W
98-631	10/30/98	9.17	W
98-631	10/30/98	6.60	W
98-631	10/30/98	4.32	W
98-631	10/30/98		
98-632	10/30/98	7.14	W
98-632	10/30/98	4.04	W
98-632	10/30/98	3.52	W
98-632	11/3/98	9.13	W
98-632	11/4/98	8.97	W
98-632	11/5/98	2.12	W
98-632	11/5/98	7.57	W
98-632	11/7/98		
98-632	11/7/98	9.88	W
98-632	11/7/98	10.81	W
98-633	11/7/98	0.53	Non W
98-633	11/7/98	9.94	W
98-633	11/8/98	8.52	W
98-633	11/8/98	3.35	W
98-633	11/8/98	3.30	W
98-633	98-6335?	8.71	W
98-633	11/8/98	3.45	W
98-633	11/8/98	1.52	W
98-633	11/8/98	2.37	W
98-633	11/8/98	5.39	W
98-634	11/8/98		
98-634	11/8/98	5.06	W
98-634	11/8/98	8.38	W
98-634	11/8/98	6.61	W
98-634	11/8/98		
98-634	11/8/98	7.40	W
98-634	11/8/98	8.97	W
98-634	11/8/98		
98-634	11/8/98		
98-634	11/8/98		
98-635	11/8/98	4.62	W
98-635	11/8/98	7.55	W
98-635	11/8/98	3.56	W
98-635	11/8/98	0.28	Non W
98-635	11/8/98	3.06	W
98-635	11/8/98	10.30	W
98-635	11/8/98		
98-635	11/8/98	1.57	W
98-635	11/8/98	8.22	W
98-635	11/8/98	7.19	W
98-636	11/8/98	5.78	W
98-638	11/8/98	2.04	W
98-638	11/8/98	3.50	W
98-638	11/8/98	7.31	W
98-638	11/8/98	6.83	W
98-638	11/8/98	6.92	W
98-639	11/8/98	5.90	W
98-639	11/8/98	6.95	W
98-639	11/8/98	2.44	W
98-639	11/8/98		
98-639	11/8/98	2.62	W
98-639	11/8/98	2.48	W
98-639	11/8/98	7.34	W
98-639	11/8/98	2.19	W
98-639	11/8/98	2.43	W

ID	COL DATE	LOD	LOD>1
98-639	11/8/98	10.17	W
98-640	11/8/98	8.34	W
98-640	11/8/98	4.91	W
98-640	11/8/98	5.53	W
98-640	11/8/98	7.14	W
98-640	11/8/98	7.75	W
98-640	11/8/98		
98-640	11/8/98	4.31	W
98-640	11/8/98	4.21	W
98-640	11/8/98		
98-640	11/8/98	7.16	W
98-641	11/8/98	8.94	W
98-641	11/8/98	2.83	W
98-641	11/8/98	4.53	W
98-641	11/8/98	11.41	W
98-641	11/8/98	4.50	W
98-641	11/8/98	1.92	W
98-641	11/8/98	8.07	W
98-641	11/8/98	1.63	W
98-641	11/8/98	7.15	W
98-641	11/8/98	8.30	W
98-642	11/8/98		
98-642	11/8/98	6.49	W
98-642	11/8/98		
98-642	11/8/98	0.36	Non W
98-642	11/8/98	5.47	W
98-642	11/8/98	6.85	W
98-642	11/8/98		
98-642	11/8/98	10.14	W
98-642	11/8/98	5.69	W
98-642	11/8/98	6.85	W
98-643	11/8/98	2.95	W
98-643	11/8/98	5.67	W
98-643	11/8/98		
98-643	11/8/98		
98-643	11/8/98	6.53	W
98-643	11/8/98	8.90	W
98-643	11/8/98	5.28	W
98-643	11/8/98		
98-643	11/8/98		
98-643	11/8/98	5.55	W
98-644	11/8/98	7.25	W
98-644	11/8/98	5.70	W
98-644	11/8/98	5.88	W
98-644	11/8/98	10.09	W
98-644	11/8/98		
98-644	11/8/98	6.66	W
98-644	11/8/98	4.22	W
98-644	11/8/98	10.39	W
98-644	11/8/98	5.53	W
98-644	11/8/98		
98-645	11/8/98	2.24	W
98-645	11/9/98	-0.46	Non W
98-645	11/10/98	9.89	W
98-645	11/12/98	6.37	W
98-645	11/12/98	8.89	W
98-645	11/12/98	7.43	W
98-645	11/12/98	2.45	W
98-645	11/13/98	7.97	W
98-645	11/9/98		
98-645	11/14/98	10.17	W
98-646	11/14/98	9.00	W
98-646	11/14/98	7.87	W
98-646	11/14/98	2.11	W
98-646	11/14/98	3.14	W
98-646	11/14/98	4.93	W
98-646	11/14/98	0.35	Non W
98-646	11/14/98	8.61	W
98-646	11/14/98		
98-646	11/14/98	7.85	W
98-646	11/14/98	0.49	Non W
98-647	11/14/98	11.07	W
98-647	11/14/98	10.70	W
98-647	11/14/98	5.98	W

Appendix B. *continued*

ID	COL DATE	LOD	LOD>1
98-647	11/14/98	-0.13	Non W
98-647	11/14/98	8.57	W
98-647	11/14/98	2.84	W
98-647	11/14/98	7.23	W
98-647	11/14/98	4.87	W
98-647	11/14/98	4.20	W
98-647	11/14/98	6.52	W
98-648	11/14/98	3.83	W
98-648	11/14/98	6.13	W
98-648	11/14/98	3.96	W
98-648	11/14/98	3.98	W
98-648	11/14/98	4.38	W
98-648	11/14/98	3.83	W
98-648	11/14/98	7.08	W
98-648	11/14/98	4.78	W
98-648	11/14/98	6.84	W
98-648	11/14/98	2.93	W
98-649	11/14/98	9.38	W
98-649	11/14/98	4.89	W
98-649	11/14/98	5.61	W
98-649	11/14/98	5.48	W
98-649	11/15/98	6.75	W
98-649	11/15/98	2.55	W
98-649	11/15/98	5.32	W
98-649	11/15/98	5.21	W
98-649	11/15/98	9.81	W
98-649	11/15/98	9.19	W
98-650	11/15/98		
98-650	11/15/98	2.02	W
98-650	11/15/98	5.79	W
98-650	11/15/98	9.69	W
98-650	11/15/98	3.36	W
98-650	11/15/98	6.81	W
98-650	11/15/98	7.36	W
98-650	11/15/98	5.90	W
98-650	11/15/98	6.89	W
98-650	11/15/98	10.21	W
98-651	11/15/98	9.55	W
98-651	11/15/98	6.19	W
98-651	11/15/98	9.24	W
98-651	11/15/98	3.28	W
98-651	11/15/98	0.86	Non W
98-651	11/15/98	4.80	W
98-651	11/15/98		
98-651	11/15/98	6.73	W
98-651	11/14/98	2.48	W
98-651	11/14/98	1.89	W
98-652	11/14/98	4.68	W
98-652	11/17/98	6.20	W
98-652	11/17/98	7.07	W
98-652	11/17/98	8.81	W
98-652	11/17/98	6.27	W
98-652	11/17/98	4.61	W
98-652	11/17/98	2.59	W
98-652	11/17/98	10.03	W
98-652	11/17/98	6.34	W
98-652	11/17/98	5.09	W
98-653	11/17/98	9.10	W
98-653	11/17/98	6.49	W
98-653	11/17/98	5.13	W
98-653	11/17/98	3.61	W
98-653	11/17/98	3.84	W
98-653	11/17/98		
98-653	11/17/98	6.49	W
98-653	11/17/98	7.57	W
98-653	11/17/98	8.30	W
98-653	11/17/98		
98-654	11/17/98	6.88	W
98-654	11/17/98	11.84	W
98-654	11/17/98	9.32	W
98-654	11/19/98	3.53	W
98-654	11/19/98	8.08	W
98-654	11/21/98		
98-654	11/21/98	2.56	W

ID	COL DATE	LOD	LOD>1
98-654	11/21/98	7.95	W
98-654	11/21/98	3.06	W
98-654	11/21/98	8.34	W
98-655	11/22/98	7.93	W
98-655	11/23/98	4.93	W
98-655	11/24/98	5.70	W
98-655	11/29/98	7.15	W
98-655	12/7/98	1.49	W
98-655	12/7/98	7.07	W
98-655	12/8/98	5.50	W
98-655	12/9/98	5.90	W
98-655	12/16/98	2.35	W
98-655	12/16/98	1.30	W
98-659	12/16/98	1.90	W
98-659	12/19/98	10.30	W
98-659	12/19/98	5.35	W
98-659	12/19/98	7.40	W
98-659	12/19/98	6.73	W
98-659	12/20/98	7.63	W
98-659	12/20/98	10.14	W
98-659	12/20/98	9.95	W
98-659	12/21/98	7.28	W
99-1	1/12/99		
99-8	1/12/99	3.89	W
99-9	1/12/99	-4.88	Non W
99-10	1/12/99		
99-11	1/12/99	-8.43	Non W
99-12	1/12/99	0.44	Non W
99-14	1/13/99	-6.78	Non W
99-15	1/13/99	-7.54	Non W
99-20	1/15/99	6.61	W
99-21	1/15/99	-2.18	Non W
99-22	1/16/99	4.40	W
99-29	1/16/99	-6.62	Non W
99-30	1/16/99	5.35	W
99-33	1/17/99	-2.39	Non W
99-34	1/17/99	7.38	W
99-40	1/17/99	-5.83	Non W
99-42	1/18/99	-1.69	Non W
99-43	1/18/99	7.79	W
99-44	1/18/99		
99-46	1/18/99	3.63	W
99-47	1/18/99	-6.99	Non W
99-48	1/18/99		
99-49	1/18/99	7.67	W
99-275	1/20/99	7.01	W
99-275	1/20/99		
99-275	1/20/99		
99-275	1/20/99		
99-275	1/20/99		
99-275	1/20/99	5.09	W
99-275	1/20/99	-2.48	Non W
99-275	1/20/99	6.54	W
99-275	1/20/99		
99-276	1/20/99	3.28	W
99-276	1/20/99	2.77	W
99-276	1/20/99		
99-276	1/20/99	-5.34	Non W
99-276	1/20/99		
99-276	1/20/99	1.39	W
99-276	1/22/99	9.25	W
99-276	1/22/99	-5.45	Non W
99-276	1/22/99	6.45	W
99-276	1/22/99	4.13	W
99-277	1/22/99		
99-277	1/22/99	7.72	W
99-277	1/22/99	-7.34	Non W
99-277	1/22/99	-1.42	Non W
99-277	1/22/99	-3.95	Non W
99-277	1/22/99	9.12	W
99-277	1/22/99	-4.52	Non W
99-56	1/26/99	7.68	W
99-57	1/26/99	7.77	W

ID	COL DATE	LOD	LOD>1
99-61	1/28/99	4.81	W
99-63	1/28/99	-4.86	Non W
99-64	1/29/99	-7.87	Non W
99-277	1/29/99	8.06	W
99-277	1/29/99	8.48	W
99-277	1/29/99	11.19	W
99-278	1/29/99	3.57	W
99-278	1/29/99	6.26	W
99-278	1/30/99		
99-278	1/30/99	7.99	W
99-278	1/30/99	8.23	W
99-278	1/31/99	7.78	W
99-65	2/1/99	1.39	W
99-66	2/1/99	3.55	W
99-70	2/2/99	-7.66	Non W
99-77	2/3/99	-5.23	Non W
99-78	2/4/99	-5.38	Non W
99-79	2/5/99	-5.56	Non W
99-81	2/12/99	3.51	W
99-89	2/12/99	6.79	W
99-90	2/12/99		
99-91	2/12/99	1.53	W
99-92	2/12/99	1.65	W
99-93	2/12/99	6.44	W
99-94	2/12/99	7.49	W
99-95	2/12/99	2.60	W
99-96	2/12/99	7.05	W
99-278	2/12/99		
99-278	2/12/99	-1.68	Non W
99-278	2/13/99		
99-278	2/13/99	-2.13	Non W
99-122	2/24/99		
99-123	2/24/99	-5.45	Non W
99-124	2/24/99	7.33	W
99-279	3/10/99	-2.99	Non W
99-279	3/27/99	-0.98	Non W
99-279	3/27/99		
99-279	3/27/99	4.34	W
99-279	4/2/99	-4.47	Non W
99-134	4/7/99	-0.16	Non W
99-135	4/7/99	-4.12	Non W
99-137	4/7/99	8.41	W
99-139	4/7/99	-2.65	Non W
99-279	4/10/99		
99-145	4/12/99	3.85	W
99-150	4/12/99	-5.20	Non W
99-153	4/13/99	-2.97	Non W
99-154	4/13/99		
99-279	4/13/99	-0.43	Non W
99-207	5/6/99		
99-279	5/7/99		
99-223	5/13/99	-7.17	Non W
99-279	7/12/99	6.24	W
99-280	7/15/99		
99-280	7/17/99	-2.15	Non W
99-280	7/19/99	3.32	W
99-280	7/23/99		
99-280	7/24/99	-0.86	Non W
99-280	7/25/99	2.61	W
99-307	7/26/99	6.83	W
99-317	7/27/99	0.83	Non W
99-319	7/27/99	1.15	W
99-320	7/27/99		
99-280	7/27/99	4.93	W
99-280	7/28/99	4.50	W
99-280	7/30/99	6.91	W
99-280	7/30/99	3.39	W
99-321	8/2/99	3.85	W
99-328	8/2/99		
99-335	8/3/99	2.88	W
99-281	8/3/99	-0.43	Non W
99-281	8/4/99	6.70	W
99-281	8/4/99	5.09	W
99-281	8/5/99	1.86	W

ID	COL DATE	LOD	LOD>1
99-281	8/5/99	7.50	W
99-281	8/6/99	7.26	W
99-281	8/6/99	5.75	W
99-281	8/6/99	3.13	W
99-281	8/6/99	5.57	W
99-281	8/6/99	5.98	W
99-282	8/6/99	6.92	W
99-282	8/6/99	6.76	W
99-282	8/7/99	-0.69	Non W
99-282	8/7/99	3.23	W
99-282	8/7/99	5.25	W
99-337	8/8/99	1.29	W
99-282	8/8/99	6.13	W
99-282	8/8/99	3.70	W
99-343	8/9/99	8.18	W
99-282	8/9/99	6.84	W
99-282	8/9/99	6.05	W
99-282	8/9/99	6.37	W
99-283	8/10/99	5.82	W
99-283	8/10/99	6.14	W
99-283	8/11/99	2.58	W
99-283	8/11/99	5.80	W
99-283	8/11/99	5.71	W
99-283	8/11/99	4.99	W
99-283	8/11/99	4.76	W
99-283	8/11/99		
99-283	8/12/99	8.83	W
99-283	8/12/99	2.28	W
99-284	8/12/99	-2.11	Non W
99-284	8/12/99	6.04	W
99-284	8/12/99	6.63	W
99-284	8/12/99	3.24	W
99-284	8/12/99	9.97	W
99-284	8/12/99	6.49	W
99-284	8/13/99	10.01	W
99-284	8/13/99	4.31	W
99-284	8/13/99	9.49	W
99-284	8/13/99	8.12	W
99-285	8/13/99	-0.44	Non W
99-285	8/13/99	6.54	W
99-285	8/14/99	5.07	W
99-285	8/14/99	8.38	W
99-353	8/15/99	6.15	W
99-354	8/15/99	8.26	W
99-355	8/15/99	9.85	W
99-356	8/15/99	7.41	W
99-357	8/15/99	5.43	W
99-285	8/15/99	9.77	W
99-285	8/15/99	7.20	W
99-285	8/15/99	3.15	W
99-285	8/16/99	7.89	W
99-285	8/16/99	9.65	W
99-285	8/16/99	6.55	W
99-286	8/16/99	4.35	W
99-286	8/16/99	10.25	W
99-286	8/16/99	8.89	W
99-360	8/17/99	4.73	W
99-286	8/17/99	5.28	W
99-286	8/17/99	10.91	W
99-286	8/18/99	7.09	W
99-286	8/18/99	5.27	W
99-286	8/18/99	6.48	W
99-286	8/18/99	9.35	W
99-286	8/18/99	7.52	W
99-287	8/19/99	6.06	W
99-287	8/19/99	8.34	W
99-287	8/19/99	1.17	W
99-287	8/19/99	6.90	W
99-287	8/19/99	8.57	W
99-287	8/20/99	8.69	W
99-287	8/20/99	7.63	W
99-287	8/20/99	11.67	W
99-287	8/20/99	7.82	W
99-287	8/20/99	12.29	W

Appendix B. *continued*

ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1	ID	COL DATE	LOD	LOD>1
99-288	8/20/99			99-294	9/12/99	3.66	W	99-324	9/27/99	9.04	W	99-307	10/20/99	11.06	W
99-369	8/24/99	7.15	W	99-295	9/12/99	4.19	W	99-324	9/27/99	10.47	W	99-307	10/21/99	10.54	W
99-288	8/25/99	9.85	W	99-295	9/12/99	3.58	W	99-324	9/27/99	10.00	W	99-307	10/22/99	4.90	W
99-288	8/25/99	1.51	W	99-295	9/12/99	10.90	W	99-324	9/27/99			99-436	10/26/99	3.95	W
99-288	8/25/99	8.32	W	99-295	9/12/99	3.42	W	99-324	9/27/99	12.22	W	99-438	10/26/99		
99-376	8/25/99	8.82	W	99-295	9/12/99	2.23	W	99-324	9/27/99	4.35	W	99-439	10/26/99	6.23	W
99-381	8/26/99	4.90	W	99-295	9/12/99	6.95	W	99-324	9/27/99	5.87	W	99-440	10/26/99	8.63	W
99-382	8/26/99	3.29	W	99-295	9/12/99	2.02	W	99-324	9/27/99	9.15	W	99-443	10/26/99	2.42	W
99-384	8/26/99	-3.63	Non W	99-295	9/12/99	8.21	W	99-324	9/27/99	10.67	W	99-444	10/26/99	7.37	W
99-288	8/28/99	8.24	W	99-295	9/13/99	3.83	W	99-324	9/28/99	9.22	W	99-446	10/26/99	5.00	W
99-288	8/28/99	6.55	W	99-295	9/21/99	9.08	W	99-325	9/28/99	10.73	W	99-307	10/26/99	7.00	W
99-288	8/28/99	4.74	W	99-296	9/21/99	9.43	W	99-325	9/28/99	4.65	W	99-307	10/26/99	7.08	W
99-288	8/28/99	6.75	W	99-296	9/21/99	4.87	W	99-325	9/28/99	7.10	W	99-307	10/27/99	10.68	W
99-288	8/30/99	6.62	W	99-296	9/21/99	5.67	W	99-325	10/1/99	7.97	W	99-307	10/27/99	6.27	W
99-288	8/30/99	7.49	W	99-296	9/21/99			99-325	10/1/99	2.91	W	99-307	10/28/99	3.72	W
99-289	8/31/99	10.26	W	99-296	9/21/99	7.74	W	99-325	10/2/99	10.20	W	99-308	10/28/99	9.14	W
99-289	8/31/99	4.82	W	99-296	9/21/99	3.38	W	99-325	10/3/99	5.87	W	99-308	10/28/99	5.59	W
99-289	8/31/99	5.33	W	99-296	9/21/99	11.43	W	99-325	10/4/99	6.37	W	99-308	10/28/99	3.82	W
99-289	9/1/99	7.70	W	99-296	9/21/99	6.41	W	99-325	10/4/99	4.75	W	99-308	10/28/99	4.50	W
99-289	9/1/99	6.68	W	99-296	9/21/99	11.32	W	99-387	10/5/99	6.83	W	99-308	10/28/99	7.02	W
99-289	9/1/99	2.24	W	99-296	9/21/99	6.46	W	99-388	10/5/99	5.40	W	99-308	10/28/99	7.13	W
99-289	9/1/99	9.51	W	99-297	9/21/99	5.30	W	99-390	10/5/99	0.61	Non W	99-308	10/28/99	5.76	W
99-289	9/1/99	9.01	W	99-297	9/21/99	6.11	W	99-391	10/5/99	5.57	W	99-308	10/28/99	10.03	W
99-289	9/1/99	5.93	W	99-297	9/21/99	8.39	W	99-396	10/5/99	4.61	W	99-308	10/28/99	9.25	W
99-289	9/2/99	8.61	W	99-297	9/21/99	4.98	W	99-304	10/5/99	9.14	W	99-308	10/28/99	5.55	W
99-290	9/2/99	8.32	W	99-297	9/21/99	10.31	W	99-304	10/5/99	6.44	W	99-309	10/28/99	5.42	W
99-290	9/2/99	9.30	W	99-297	9/21/99	2.58	W	99-325	10/5/99	9.07	W	99-309	10/28/99	5.87	W
99-290	9/2/99	7.53	W	99-297	9/21/99	9.91	W	99-392	10/6/99	9.16	W	99-309	10/28/99	9.83	W
99-290	9/2/99	6.81	W	99-297	9/21/99	5.02	W	99-393	10/6/99	7.95	W	99-309	10/28/99	10.04	W
99-290	9/2/99	9.09	W	99-297	9/21/99	4.89	W	99-394	10/6/99	9.43	W	99-309	10/28/99	7.55	W
99-290	9/2/99	10.70	W	99-297	9/21/99	7.13	W	99-395	10/6/99	5.19	W	99-309	10/28/99	5.21	W
99-290	9/3/99	7.78	W	99-298	9/21/99	7.42	W	99-398	10/6/99	9.97	W	99-309	10/28/99	3.98	W
99-290	9/3/99	3.66	W	99-298	9/21/99	5.81	W	99-304	10/6/99	5.89	W	99-309	10/28/99	8.91	W
99-290	9/3/99	3.87	W	99-298	9/21/99	5.52	W	99-399	10/7/99	5.18	W	99-309	10/28/99	10.28	W
99-290	9/3/99	6.65	W	99-298	9/21/99	6.91	W	99-304	10/7/99	9.43	W	99-309	10/28/99	3.99	W
99-291	9/4/99	5.71	W	99-298	9/21/99	9.63	W	99-304	10/8/99	8.14	W	99-310	10/28/99	6.52	W
99-291	9/4/99	9.35	W	99-298	9/21/99	9.06	W	99-304	10/8/99	4.97	W	99-310	10/28/99	7.13	W
99-291	9/4/99	8.15	W	99-298	9/21/99	8.62	W	99-305	10/8/99	10.74	W	99-310	10/28/99	11.51	W
99-291	9/5/99	8.03	W	99-298	9/21/99	10.80	W	99-305	10/8/99	10.29	W	99-310	10/28/99	4.10	W
99-291	9/5/99	8.12	W	99-298	9/21/99	4.24	W	99-305	10/8/99	3.64	W	99-310	10/28/99	3.97	W
99-291	9/5/99	7.16	W	99-298	9/21/99	7.54	W	99-305	10/8/99	7.79	W	99-310	10/28/99	6.69	W
99-291	9/6/99	10.04	W	99-299	9/21/99	5.98	W	99-305	10/8/99	7.50	W	99-310	10/28/99		
99-291	9/7/99	8.37	W	99-299	9/21/99	8.54	W	99-401	10/12/99	6.77	W	99-310	10/28/99	6.70	W
99-291	9/7/99	6.34	W	99-299	9/21/99	4.27	W	99-403	10/12/99	8.44	W	99-310	10/28/99	9.18	W
99-291	9/7/99	4.25	W	99-299	9/21/99	2.38	W	99-405	10/12/99	4.68	W	99-310	10/28/99		
99-292	9/8/99	8.48	W	99-299	9/21/99	4.73	W	99-406	10/12/99	4.10	W	99-311	10/28/99	3.39	W
99-292	9/8/99	9.51	W	99-299	9/21/99	4.86	W	99-407	10/12/99	6.51	W	99-311	10/28/99		
99-292	9/8/99	7.48	W	99-299	9/21/99	5.96	W	99-408	10/12/99	6.20	W	99-311	10/28/99		
99-292	9/10/99	6.37	W	99-299	9/21/99	6.13	W	99-409	10/12/99	5.00	W	99-311	10/29/99	8.67	W
99-292	9/10/99	5.97	W	99-299	9/21/99	6.78	W	99-410	10/12/99	6.05	W	99-311	10/29/99	5.88	W
99-292	9/10/99	7.16	W	99-299	9/21/99	10.39	W	99-411	10/12/99	3.66	W	99-311	10/29/99	7.11	W
99-292	9/10/99	7.69	W	99-300	9/21/99	8.16	W	99-305	10/13/99	10.56	W	99-311	10/29/99	6.55	W
99-292	9/10/99	3.01	W	99-321	9/21/99	5.98	W	99-305	10/13/99	6.04	W	99-311	10/29/99	4.02	W
99-292	9/10/99	9.15	W	99-321	9/21/99	10.41	W	99-305	10/14/99	5.04	W	99-312	10/29/99	5.03	W
99-292	9/10/99	7.25	W	99-322	9/21/99	8.55	W	99-305	10/14/99	11.48	W	99-312	10/29/99	5.61	W
99-293	9/10/99	5.38	W	99-322	9/21/99	8.64	W	99-305	10/15/99	7.16	W	99-312	10/29/99	7.64	W
99-293	9/10/99	-0.44	Non W	99-322	9/21/99	6.04	W	99-306	10/15/99	6.59	W	99-312	10/29/99	6.03	W
99-293	9/10/99	8.53	W	99-322	9/21/99	4.74	W	99-306	10/16/99	1.71	W	99-312	10/29/99	9.03	W
99-293	9/11/99	8.98	W	99-322	9/21/99	4.21	W	99-306	10/16/99	7.70	W	99-312	10/29/99	10.33	W
99-293	9/11/99	10.18	W	99-322	9/21/99	8.83	W	99-306	10/16/99	10.21	W	99-312	10/29/99	5.02	W
99-293	9/11/99	7.90	W	99-322	9/21/99	0.10	Non W	99-306	10/16/99	9.03	W	99-312	10/29/99	9.21	W
99-293	9/11/99	8.34	W	99-322	9/21/99	4.26	W	99-306	10/16/99	3.94	W	99-312	10/29/99	1.55	W
99-293	9/11/99	8.30	W	99-322	9/21/99	4.33	W	99-306	10/16/99	10.08	W	99-312	10/29/99	4.16	W
99-293	9/11/99	7.69	W	99-322	9/21/99	4.96	W	99-306	10/19/99	6.52	W	99-313	10/29/99	4.37	W
99-293	9/11/99	8.14	W	99-323	9/23/99	3.19	W	99-306	10/19/99	7.00	W	99-313	10/29/99	5.77	W
99-294	9/11/99	10.11	W	99-323	9/24/99	9.26	W	99-417	10/20/99	-0.42	Non W	99-313	10/29/99	1.42	W
99-294	9/11/99	11.49	W	99-323	9/24/99	5.17	W	99-418	10/20/99			99-313	10/29/99		
99-294	9/11/99	10.26	W	99-323	9/24/99	5.63	W	99-419	10/20/99	9.61	W	99-313	10/29/99		
99-294	9/11/99	10.06	W	99-323	9/24/99	-1.31	Non W	99-420	10/20/99	4.78	W	99-313	10/29/99		
99-294	9/11/99	10.74	W	99-323	9/25/99	10.58	W	99-423	10/20/99	5.02	W	99-313	10/29/99	4.59	W
99-294	9/12/99	6.30	W	99-323	9/26/99	7.97	W	99-425	10/20/99			99-313	10/29/99	5.71	W
99-294	9/12/99	7.88	W	99-323	9/26/99	7.16	W	99-426	10/20/99	4.17	W	99-313	10/29/99	10.30	W
99-294	9/12/99	7.21	W	99-323	9/26/99	8.26	W	99-306	10/20/99	4.63	W	99-314	10/29/99	1.38	W
99-294	9/12/99	10.63	W	99-323	9/26/99	8.97	W	99-307	10/20/99	4.86	W	99-314	10/29/99	11.13	W

Appendix B. *continued*

ID	COL DATE	LOD	LOD>1
99-314:	10/29/99	5.09	W
99-314:	10/29/99	10.77	W
99-314.	10/29/99	10.15	W
99-314!	10/29/99	9.23	W
99-314(	10/29/99	6.04	W
99-314'	10/29/99	9.27	W
99-314:	10/29/99		
99-314!	10/29/99	2.97	W
99-315(	10/29/99		
99-315.	10/29/99	7.23	W
99-315:	10/29/99		
99-315:	10/29/99		
99-315!	10/29/99	7.62	W
99-315(	10/29/99	10.44	W
99-315'	10/29/99	2.09	W
99-315:	10/29/99		
99-315!	10/29/99		
99-316(	10/29/99		
99-316.	10/29/99		
99-316:	10/29/99	4.46	W
99-316:	10/29/99	6.23	W
99-316.	10/29/99	7.09	W
99-316!	10/29/99	6.08	W
99-316(	10/29/99	6.74	W
99-316'	10/29/99	6.22	W
99-316:	10/29/99	7.37	W
99-316!	10/29/99	8.75	W
99-317(	10/29/99	7.10	W
99-317.	10/29/99	5.41	W
99-317:	10/29/99	4.43	W
99-317:	10/29/99	6.83	W
99-317.	10/29/99	3.36	W
99-317!	10/29/99	5.23	W
99-317(	10/29/99	8.01	W
99-317'	10/29/99	6.70	W
99-317:	10/29/99	11.43	W
99-317!	10/29/99	4.86	W
99-318(	10/29/99	9.58	W
99-318.	10/29/99		
99-318:	10/29/99	3.82	W
99-318:	10/29/99	3.88	W
99-318.	10/29/99	6.79	W
99-318!	10/29/99	5.84	W
99-318(	10/29/99	7.40	W
99-318'	10/29/99		
99-318:	10/29/99		
99-318!	10/29/99	3.62	W
99-319(	10/29/99	3.72	W
99-319.	10/29/99	11.98	W
99-319:	10/29/99	5.61	W
99-319:	10/29/99	11.35	W
99-319.	10/29/99	6.84	W
99-319!	10/29/99	8.69	W
99-319(	10/29/99	4.11	W
99-319'	10/29/99	7.66	W
99-319:	10/29/99	7.47	W
99-319!	10/29/99	3.89	W
99-320(	10/29/99	8.19	W
99-320.	10/29/99	6.10	W
99-320:	10/29/99	5.18	W
99-329:	10/29/99		
99-329.	10/29/99		
99-450	11/2/99	6.23	W
99-451	11/2/99	1.88	W
99-453	11/2/99		
99-456	11/2/99		
99-457	11/2/99		
99-320:	11/2/99	6.26	W
99-458	11/3/99	6.60	W
99-459	11/3/99	5.45	W
99-461	11/3/99		
99-462	11/3/99	2.44	W
99-463	11/3/99	10.34	W
99-320.	11/4/99		

ID	COL DATE	LOD	LOD>1
99-320!	11/4/99		
99-320(	11/4/99	8.26	W
99-320'	11/8/99	7.91	W
99-320:	11/8/99	7.60	W
99-320!	11/8/99	6.72	W
99-321(	11/8/99	5.14	W
99-321.	11/8/99	4.48	W
99-321:	11/8/99		
99-321:	11/8/99	9.75	W
99-465	11/9/99		
99-467	11/9/99	7.10	W
99-470	11/9/99	0.78	Non W
99-471	11/9/99		
99-321.	11/9/99	7.35	W
99-321!	11/9/99	7.63	W
99-473	11/11/99	6.15	W
99-474	11/11/99	10.54	W
99-477	11/11/99	4.77	W
99-478	11/11/99	6.26	W
99-479	11/11/99	5.63	W
99-480	11/11/99	2.58	W
99-321(	11/12/99	6.32	W
99-482	11/16/99	-5.51	Non W
99-484	11/16/99	8.91	W
99-485	11/16/99	6.27	W
99-486	11/16/99	5.90	W
99-487	11/16/99	5.07	W
99-488	11/17/99		
99-489	11/17/99		
99-491	11/17/99	5.62	W
99-492	11/17/99	3.51	W
99-493	11/17/99	7.09	W
99-495	11/18/99	8.88	W
99-496	11/18/99	8.18	W
99-321'	11/18/99	8.71	W
99-326(	11/21/99	5.13	W
99-326.	11/21/99	5.82	W
99-497	11/22/99	8.25	W
99-498	11/22/99	8.31	W
99-499	11/22/99	4.92	W
99-500	11/22/99	6.67	W
99-502	11/24/99	4.02	W
99-503	11/24/99	8.25	W
99-507	11/24/99	3.67	W
99-326:	11/24/99		
99-508	11/27/99	9.06	W
99-511	11/27/99	6.10	W
99-512	11/27/99	4.91	W
99-514	11/28/99		
99-515	11/28/99		
99-517	11/28/99	3.38	W
99-519	11/28/99	9.04	W
99-522	11/29/99	7.41	W
99-523	11/29/99	-0.56	Non W
99-524	11/30/99	6.34	W
99-525	11/30/99	5.78	W
99-526	11/30/99	6.73	W
99-527	11/30/99		
99-326:	11/30/99		
99-326.	12/2/99		
99-326!	12/4/99	2.36	W
99-326(	12/4/99	6.93	W
99-326'	12/11/99	1.02	W
99-326:	12/11/99	6.89	W
99-326!	12/11/99	4.36	Non W
99-327(	12/13/99	10.72	W
99-327.	12/13/99	5.16	W
99-327:	12/13/99	7.58	W
99-327:	12/17/99	4.04	W
99-327.	12/18/99	4.17	W
99-327!	12/18/99	-2.55	Non W
99-327(	12/20/99	6.67	W
99-327'	12/20/99		
99-327:	12/20/99		

ID	COL DATE	LOD	LOD>1
99-327!	12/20/99		
99-328(	12/20/99	2.69	W
99-328.	12/20/99	5.42	Non W
99-328:	12/20/99	9.49	W
99-328:	12/21/99	-6.17	Non W
99-328.	12/21/99		
99-328!	12/22/99	5.01	W
99-328(	12/22/99	4.85	W
99-328'	12/22/99	6.29	W
99-328:	12/22/99	-6.14	Non W
99-328!	12/22/99	10.17	W
99-329(	12/23/99	10.94	W
99-329.	12/23/99	6.36	W
99-329:	12/29/99		
00-000:	1/3/00	-6.91	Non W
00-000!	1/3/00	10.17	W
00-000(	1/3/00	6.69	W
00-000:	1/3/00	####	Non W
00-000!	1/4/00	9.12	W
00-270.	1/6/00	6.49	W
00-270:	1/6/00	-4.01	Non W
00-270:	1/7/00	6.14	W
00-270.	1/7/00	8.27	W
00-001(	1/8/00	-3.94	Non W
00-001.	1/8/00	-6.08	Non W
00-001:	1/8/00	-5.11	Non W
00-001:	1/8/00	-9.72	Non W
00-001.	1/8/00	-5.69	Non W
00-001!	1/8/00	9.09	W
00-001(	1/8/00	-1.58	Non W
00-270!	1/8/00	7.42	W
00-270(	1/8/00	-3.01	Non W
00-270'	1/8/00	4.97	W
00-270:	1/8/00	6.55	W
00-270!	1/9/00	5.12	W
00-271(	1/9/00		
00-001'	1/10/00	7.21	W
00-001:	1/10/00	-5.56	Non W
00-001!	1/10/00	7.17	W
00-271.	1/11/00	5.29	W
00-271:	1/12/00	10.18	W
00-271:	1/12/00		
00-271.	1/12/00	-5.68	Non W
00-271!	1/12/00	6.25	W
00-271(	1/12/00	-6.79	Non W
00-271'	1/12/00		
00-271:	1/12/00	3.46	W
00-271!	1/12/00		
00-272(	1/12/00	-3.77	Non W
00-272.	1/12/00	0.78	Non W
00-272:	1/12/00	6.47	W
00-272:	1/12/00	0.08	Non W
00-272.	1/12/00	-9.01	Non W
00-272!	1/12/00	-7.67	Non W
00-272(	1/12/00	-8.05	Non W
00-272'	1/12/00	-2.94	Non W
00-272:	1/12/00	4.80	W
00-272!	1/12/00	-6.46	Non W
00-273(	1/12/00	4.92	W
00-273.	1/12/00		
00-273:	1/12/00	-5.78	Non W
00-273:	1/12/00	9.35	W
00-273.	1/12/00	-2.72	Non W
00-273!	1/12/00		
00-273(	1/12/00		
00-273'	1/12/00		
00-273:	1/12/00		
00-273!	1/12/00		
00-274(	1/12/00		
00-274.	1/12/00	7.96	W
00-274:	1/12/00		
00-274:	1/12/00	-2.79	Non W
00-274.	1/12/00	-0.70	Non W

ID	COL DATE	LOD	LOD>1
00-274!	1/12/00		
00-274(	1/12/00	-7.98	Non W
00-274'	1/12/00	-3.22	Non W
00-274:	1/12/00	5.44	W
00-274!	1/12/00		
00-275(	1/12/00	-5.11	Non W
00-275.	1/12/00	6.62	W
00-275:	1/12/00		
00-275:	1/12/00		
00-275.	1/12/00		
00-275!	1/12/00	-2.45	Non W
00-275(	1/12/00	-2.91	Non W
00-275'	1/12/00		
00-275:	1/12/00		
00-275!	1/12/00	-4.31	Non W
00-276(	1/12/00		
00-276.	1/12/00		
00-276:	1/12/00		
00-276:	1/12/00		
00-276.	1/12/00		
00-276!	1/12/00		
00-276(	1/12/00	-4.04	Non W
00-276'	1/12/00	5.62	W
00-276:	1/12/00	3.35	W
00-002(	1/18/00	10.83	W
00-276!	1/20/00	8.01	W
00-003:	2/2/00	-7.08	Non W
00-003!	2/2/00	-6.09	Non W
00-004(	2/2/00	-6.63	Non W
00-004.	2/2/00	6.55	W
00-004(	2/3/00		
00-004!	2/3/00	-8.95	Non W
00-005'	2/6/00	-6.01	Non W
00-006.	2/7/00	-3.78	Non W
00-006(	2/8/00	-8.77	Non W
00-007(	2/8/00	5.17	W
00-007.	2/8/00	7.55	W
00-007.	2/9/00	-5.08	Non W
00-007(	2/9/00	4.70	W
00-007'	2/9/00	-4.46	Non W
00-008.	2/9/00	####	Non W
00-008!	2/18/00		Steelhead
00-008(	2/18/00		
00-008:	2/18/00	-4.60	Non W
00-009.	2/21/00	-5.76	Non W
00-010.	2/28/00	-3.27	Non W
00-012.	3/9/00	-6.72	Non W
00-012!	3/9/00	-5.63	Non W
00-012(	3/9/00	0.50	Non W
00-012'	3/11/00	-3.07	Non W
00-013.	3/15/00		
00-013.	3/15/00	11.21	W
00-013:	3/15/00	-1.76	Non W
00-013'	3/15/00	-6.13	Non W
00-013:	3/15/00	-5.94	Non W
00-014.	3/15/00	6.79	W
00-014:	3/15/00	-4.32	Non W
00-014:	3/15/00	-7.28	Non W
00-014.	3/15/00		
00-277(	3/19/00	-7.37	Non W
00-015.	4/2/00		
00-015:	4/2/00		Steelhead
00-016.	4/10/00	-2.64	Non W
00-022(	5/7/00	-9.35	Non W
00-650.	8/29/00	9.06	W
00-650:	9/13/00	8.51	W
00-650:	9/13/00	8.12	W
00-650.	9/13/00	8.70	W
00-650!	9/13/00	0.30	Non W
00-650(	9/13/00	8.86	W
00-650'	9/13/00	7.96	W
00-650:	9/13/00	3.45	W
00-650!	9/13/00	8.99	W
00-651(	9/13/00	4.17	W

Appendix B. *continued*

ID	COL DATE	LOD	LOD>1
00-651	9/14/00	8.74	Non W
00-651	9/14/00	5.26	Non W
00-651	9/14/00	4.39	Non W
00-651	9/14/00	9.58	Non W
00-651	9/14/00	1.26	Non W
00-651	9/14/00	4.36	Non W
00-651	9/14/00	9.82	Non W
00-651	9/14/00	9.69	Non W
00-651	9/14/00	9.80	Non W
00-652	9/14/00	8.27	Non W
00-652	9/14/00	4.62	Non W
00-652	9/14/00	9.09	Non W
00-652	9/14/00	8.36	Non W
00-652	9/27/00	2.42	Non W
00-652	9/27/00	9.45	Non W
00-652	9/27/00	6.85	Non W
00-652	9/27/00		
00-652	9/27/00	12.91	Non W
00-652	9/27/00	5.54	Non W
00-653	9/27/00	6.51	Non W
00-653	9/27/00	7.72	Non W
00-653	9/27/00	5.51	Non W
00-653	9/27/00	8.21	Non W
00-653	9/27/00	9.25	Non W
00-653	9/27/00	6.32	Non W
00-653	9/27/00	6.82	Non W
00-653	9/27/00	4.92	Non W
00-653	9/27/00	4.30	Non W
00-653	9/27/00	9.67	Non W
00-654	9/27/00	1.76	Non W
00-654	9/29/00	8.51	Non W
00-654	9/29/00	8.34	Non W
00-654	9/29/00	3.33	Non W
00-654	9/29/00	11.61	Non W
00-654	9/29/00	8.77	Non W
00-654	9/29/00	8.48	Non W
00-654	9/29/00	10.25	Non W
00-654	10/11/00	9.09	Non W
00-654	10/11/00	9.86	Non W
00-655	10/11/00	3.05	Non W
00-655	10/11/00	5.70	Non W
00-655	10/11/00	8.35	Non W
00-655	10/11/00	9.50	Non W
00-655	10/11/00	5.83	Non W
00-655	10/11/00	5.93	Non W
00-655	10/11/00	8.99	Non W
00-655	10/12/00	8.54	Non W
00-655	10/12/00	6.41	Non W
00-655	10/12/00	10.42	Non W
00-656	10/12/00	7.92	Non W
00-656	10/12/00	5.52	Non W
00-656	10/12/00	10.84	Non W
00-656	10/12/00	4.32	Non W
00-656	10/12/00	4.33	Non W
00-656	10/12/00	11.86	Non W
00-656	10/12/00	6.96	Non W
00-656	10/13/00	6.69	Non W
00-656	11/1/00	9.31	Non W
00-656	11/1/00	10.82	Non W
00-657	11/2/00	3.99	Non W
00-657	11/2/00	10.63	W
00-657	11/2/00	4.14	W
00-657	11/2/00	1.63	W
00-657	11/3/00	5.98	W
00-657	11/3/00		
00-657	11/3/00	2.32	W
00-657	11/3/00	6.04	W
00-657	11/3/00	7.22	W
00-657	11/16/00	7.55	W
00-658	11/16/00	5.69	W
00-658	11/16/00	7.65	W
00-658	11/16/00	10.39	W
00-658	11/16/00	9.12	W
00-658	11/16/00	6.17	W

ID	COL DATE	LOD	LOD>1
00-658	11/16/00	5.06	W
00-658	11/16/00	7.44	W
00-658	11/16/00	10.79	W
00-658	11/16/00	8.86	W
00-658	11/16/00	6.83	W
00-660	11/16/00	8.53	W
00-659	11/30/00	5.76	W
00-659	11/30/00	5.75	W
00-659	11/30/00	9.52	Non W
00-659	11/30/00	6.94	W
00-659	11/30/00	0.47	Non W
00-659	11/30/00	6.57	W
00-659	11/30/00	6.35	W
00-659	11/30/00	7.70	W
00-659	11/30/00	9.06	W
00-659	11/30/00	6.29	W
00-660	11/30/00	6.44	W
00-660	11/30/00	3.19	W
00-660	11/30/00		
00-660	11/30/00	7.09	W
00-660	11/30/00	5.19	W
00-660	11/30/00	6.05	W
00-660	11/30/00	1.86	W
00-660	11/30/00	7.14	W

Appendix C. "Rapid Response" samples trapped at Battle Creek, Keswick Dam and Red Bluff Diversion Dam, 1997-2001.

SAMPLE ID	DATE TO BML	USFWS NOTIFIE	ADIPOSE CLIP	# LOCI	LOD	LOD>1
97-263BC	35501	35506	AD	5	-2.70917	non W
97-264BC	35502	35506	AD	5	-3.8131	non W
97-265BC	35502	35506	AD	5	-6.48598	non W
97-266BC	35502	35506	AD	5	3.47884	W
97-267BC	35502	35506	AD	5	-4.43561	non W
97-268BC	35509	35514	AD	5	5.02319	W
97-269BC	35503	35507	AD	5	5.25026	W
97-270BC	35509	35514	AD	5	1.41272	non W
97-271BC	35506	35509	AD	5	1.44348	non W
97-272BC	35507	35509	AD	5	4.88696	W
97-273BC	35507	35509	AD	5	5.59748	W
97-274BC	35507	35509	AD	5	6.77079	W
97-275BC	35507	35509	AD	5	6.96361	W
97-276BC	35507	35509	AD	5	5.62441	W
97-277BC	35507	35509	AD	5	6.03016	W
97-279BC	35507	35509	AD	5	-1.74999	non W
97-280BC	35507	35509	AD	5	3.29483	W
97-281BC	35507	35509	AD	5	6.18372	W
97-282BC	35507	35509	AD	5	5.30691	W
97-283BC	35507	35509	AD	5	3.59374	W
97-284BC	35507	35509	AD	5	3.87388	W
97-285BC	35507	35509	AD	5	-1.35273	non W
97-286BC	35508	35509	AD	5	4.44001	W
97-287BC	35508	35510	AD	5	2.79286	W
97-288BC	35507	35509	AD	5	5.71631	W
97-289BC	35507	35509	AD	5	4.44977	W
97-290BC	35507	35509	AD	5	-4.96331	non W
97-291BC	35507	35509	AD	5	0.731956	non W
97-292BC	35508	35510	unmarked	5	-4.6581	non W
97-293BC	35508	35510	AD	5	-1.59344	non W
97-294BC	35508	35510	AD	5	-3.65624	non W
97-295BC	35508	35509	AD	5	2.98549	W
97-296BC	35509	35510	AD	5	5.1808	W
97-297BC	35509	35510	AD	5	7.27299	W
97-298BC	35509	35514	AD	5	5.94924	W
97-299BC	35509	35514	AD	5	-6.8675	non W
97-300BC	35510	35513	unmarked	5	5.85152	W
97-301BC	35510	35513	AD	5	6.18077	W
97-302BC	35510	35514	AD	5	3.10926	W
97-303BC	35514	35520	AD	5	-3.3863	non W
97-304BC	35514	35520	AD	4	-3.96917	non W
97-305BC	35514	35520	AD	5	-6.1407	non W
97-306BC	35514	35515	unmarked	5	8.37161	W
97-307BC	35514	35520	AD	5	-5.07461	non W
97-308BC	35514	35515	AD	5	5.4871	W
97-309BC	35514	35515	AD	5	4.80588	W
97-310BC	35514	35515	AD	5	6.92954	W
97-311BC	35514	35515	AD	5	1.3134	non W
97-312BC	35516	35520	unmarked	5	2.47949	W
97-313BC	35516	35517	AD	5	5.37346	W
97-314BC	35520	35522	AD	5	4.60053	W
97-315BC	35522	35523	AD	4	-3.44772	non W
97-316BC	35522	35523	unmarked	5	-6.46014	non W
97-317BC	35522	35523	AD	5	4.44001	W
97-318BC	35522	35523	AD	5	4.90955	W
97-319BC	35522	35527	AD	5	3.82165	W
97-320BC	35528	35529	unmarked	5	3.13522	W
97-321BC	35528	35529	AD	5	5.35906	W
97-322BC	35528	35529	AD	4	2.54032	W
97-323BC	35528	35529	unmarked	5	7.74666	W
97-324BC	35535	35536	AD	5	5.11408	W
97-325BC	35535	35536	AD	5	2.5122	W
97-326BC	35535	35536	AD	5	6.14964	W
97-327BC	35535	35536	AD	5	6.14964	W
97-328BC	35536	35537	AD	5	2.04945	W
97-329BC	35536	35537	AD	5	5.11408	W
97-330BC	35536	35537	AD	5	7.00506	W
97-331BC	35536	35537	AD	5	3.70596	W
97-332BC	35536	35537	AD	5	7.81647	W
97-333BC	35536	35537	AD	5	2.38326	W
97-334BC	35537	35541	unmarked	5	-1.68925	non W
97-335BC	35541	35542	AD	5	3.94718	W
97-336BC	35541	35542	unmarked	5	-4.1483	non W
97-337BC	35541	35542	AD	5	3.08172	W
97-338BC	35541	35542	AD	5	5.95664	W
97-339BC	35541	35542	AD	5	5.30691	W
97-340BC	35541	35542	AD	5	2.40804	W
97-341BC	35541	35542	AD	5	4.04622	W
97-342BC	35542	35544	AD	5	0.65936	non W
97-343BC	35542	35543	AD	5	6.2162	W
97-344BC	35542	35543	AD	5	2.54276	W
97-345BC	35542	35543	AD	5	5.13047	W
97-346BC	35542	35543	AD	5	3.31862	W
97-347BC	35542	35543	AD	5	3.38595	W
97-348BC	35542	35543	AD	5	1.30327	non W
97-349BC	35542	35543	AD	5	5.94631	W
97-350BC	35542	35543	AD	5	5.37346	W
97-351BC	35542	35543	AD	5	5.45303	W
97-352BC	35542	35543	AD	5	8.59872	W
97-353BC	35542	35543	unmarked	5	-7.41093	non W
97-354BC	35542	35543	AD	5	3.78621	W
97-355BC	35542	35543	AD	5	-0.97721	non W
97-356BC	35542	35543	AD	5	1.75216	non W
97-357BC	35542	35543	AD	5	6.20044	W
97-358BC	35542	35543	AD	5	1.30816	non W
97-359BC	35542	35543	AD	5	4.90955	W
97-360BC	35542	35543	AD	5	6.20044	W
97-361BC	35542	35543	AD	5	4.27949	W
97-362BC	35542	35543	AD	5	3.48958	W
97-363BC	35542	35543	AD	5	5.84996	W
97-364BC	35544	35545	unmarked	5	-5.68934	non W
97-365BC	35544	35545	AD	5	4.57857	W
97-366BC	35544	35545	AD	5	5.42247	W
97-367BC	35545	35548	AD	5	6.87976	W
97-368BC	35545	35548	AD	5	3.71519	W
97-369BC	35545	35548	AD	5	-4.05919	non W
97-370BC	35548	35550	AD	3	4.1712	W
97-371/35	35548	35549	AD	5	-0.97721	non W
97-372/35	35548	35549	AD	5	3.78621	W
97-373BC	35548	35549	AD	5	6.90717	W
97-374BC	35549	35550	AD	4	0.551706	non W
97-375BC	35549	35550	AD	5	5.48685	W
97-376BC	35549	35550	unmarked	4	-5.21373	non W
97-377BC	35549	35550	AD	4	-2.25803	non W
97-378BC	35555	35556	AD	5	5.98912	W
97-379BC	35555	35556	AD	4	6.8652	W
97-380BC	35556	35559	unmarked	5	-5.60769	non W
97-381BC	35557	35559	unmarked	5	-4.08135	non W
98-3000B(	35871	35874	AD	5	3.18	W
98-3001B(	35859	35860		5	-2.13	non W
98-3002B(	35859	35860	unmarked	5	-6.6	non W
98-3003B(	35859	35860		5	-5.02	non W
98-3004B(	35860	35863		5	-7.21	non W
98-3005B(	35860	35863		5	-5.59	non W
98-3006B(	35860	35863		5	-4.39	non W
98-3007B(	35860	35863		5	-5.14	non W
98-3008B(	35863	35864		5	-2.69	non W
98-3009B(	35863	35864		5	-3.88	non W
98-3010B(	35863	35864		5	-2.61	non W
98-3011B(	35864	35865		5	-3.26	non W
98-3012B(	35864	35865		5	-3.33	non W
98-3013B(	35864	35865		5	-3.62	non W
98-3014B(	35864	35865		5	-3.11	non W
98-3015B(	35864	35865		5	-5.6	non W
98-3016B(	35864	35865		5	-6.1	non W
98-3017B(	35864	35865		5	-5.69	non W
98-3018B(	35864	35865		5	-4.81	non W
98-3019B(	35864	35865		5	-4.8	non W
98-3020B(	35864	35865		5	-4.77	non W
98-3021B(	35864	35865		5	-4.52	non W
98-3022B(	35864	35865		5	-2.95	non W
98-3023B(	35864	35865		5	-2.76	non W
98-3024B(	35864	35865		5	-2.65	non W
98-3025B(	35865	35866		5	-5.34	non W
98-3026B(	35865	35866		5	-4.11	non W
98-3027B(	35865	35866		5	-1.94	non W
98-3028B(	35865	35866		5	-2.93	non W
98-3029B(	35865	35866		5	-6.81	non W
98-3030B(	35866	35873	AD	7	5.19	W
98-3031B(	35866	35873		5	-6.53	non W
98-3032B(	35866	35873		5	-4.68	non W
98-3033B(	35866	35873		5	-4.84	non W

Appendix C. continued

SAMPLE ID	DATE TO BML	USFWS NOTIFIE	ADIPOSE CLIP	# LOCI	LOD	LOD>1
98-3034B(	35866	35873		5	-5.53	non W
98-3035B(	35867	35873	unmarked	5	-3.24	non W
98-3036B(	35867	35873		5	-6.72	non W
98-3037B(	35867	35873		5	-1.87	non W
98-3038B(	35867	35873		5	-5.25	non W
98-3039B(	35867	35873	AD	5	3.03	W
98-3040B(	35867	35873	unmarked	5	3.99	W
98-3041B(	35867	35873		5	-3.85	non W
98-3042B(	35871	35873		5	-1.1	non W
98-3043B(	35871	35873		5	-3.28	non W
98-3044B(	35871	35873		5	-3.93	non W
98-3045B(	35871	35873		5	-3.4	non W
98-3046B(	35871	35873		5	-3.95	non W
98-3047B(	35871	35873		5	-3.74	non W
98-3048B(	35871	35873		5	-5.07	non W
98-3049B(	35871	35873		5	-5.21	non W
98-3050B(	35871	35873		5	-6.21	non W
98-3051B(	35871	35873		5	-3.47	non W
98-3052B(	35871	35873	not caugh	5	-8.29	non W
98-3053B(	35871	35874		5	-4.76	non W
98-3054B(	35871	35873		5	-7.1	non W
98-3055B(	35871	35873		5	-5.32	non W
98-3056B(	35871	35873		5	-4.83	non W
98-3057B(	35871	35873		5	-8.26	non W
98-3058B(	35871	35873		5	-4.19	non W
98-3059B(	35871	35873		5	-5.31	non W
98-3060B(	35871	35873		5	-3.45	non W
98-3061B(	35871	35873		5	-2.83	non W
98-3062B(	35873	35874		5	-3.99	non W
98-3063B(	35874	35878		5	-8.62	non W
98-3064B(	35874	35878		5	-5.67	non W
98-3065B(	35877	35878	unmarked	5	-6.53	non W
98-3066B(	35877	35878		5	-4.53	non W
98-3067B(	35877	35878		5	-3.97	non W
98-3068B(	35877	35878		5	-5.67	non W
98-3069B(	35877	35878		5	-4.06	non W
98-3070B(	35877	35878		5	-4.22	non W
98-3071B(	35885	35888		5	-3.2	non W
98-3072B(	35887	35888		5	-1.39	non W
98-3073B(	35888	35892		5	-5.83	non W
98-3074B(	35888	35892	AD	5	2.67	W
98-3075B(	35891	35892		5	-4.44	non W
98-3076B(	35891	35892	unmarked	5	5.88	W
98-3077B(	35892	35893		5	-2.4	non W
98-3078B(	35892	35893	AD	5	2.37	W
98-3079B(	35892	35893	AD	5	3.61	W
98-3080K	35894	35895		5	2.01	W
98-3081K	35894	35895		5	3.91	W
98-3082K	35894	35895		5	-3.1	non W
98-3083K	35894	35895	AD	5	7.94	W
98-3084K	35894	35895	AD	7	4.56	W
98-3085K	35894	35895		5	6.91	W
98-3086K	35894	35895		5	4.12	W
98-3087K	35894	35895	AD	5	6.19	W
98-3088K	35894	35895		5	3.25	W
98-3089K	35894	35895	AD	7	0.41	BY95-22O
98-3090K	35894	35895		5	-1.61	non W
98-3091B(	35898	35900	unmarked	5	5.97	W
98-3092K	35898	35900		5	-4.28	non W
98-3093K	35898	35900		5	5.71	W
98-3094K	35898	35900		5	-7.68	non W
98-3095K	35898	35900		5	5.19	W
98-3096K	35898	35900		5	-2.71	non W
98-3097K	35898	35900		5	3.4	W
98-3098K	35898	35900		5	-6.4	non W
98-3099K	35898	35900		5	5.33	W
98-3100K	35898	35900		5	3.25	W
98-3101K	35898	35900		5	4.05	W
98-3102K	35898	35900		5	1.77	non W
98-3103K	35898	35900	AD	5	5.28	W
98-3104K	35898	35900		5	2.48	W
98-3105K	35898	35900		5	2	non W
98-3106K	35898	35900	AD	5	5.29	W
98-3107K	35898	35900		5	4.72	W
98-3108K	35898	35900		5	6.74	W
98-3109K	35898	35900		5	3.51	W

SAMPLE ID	DATE TO BML	USFWS NOTIFIE	ADIPOSE CLIP	# LOCI	LOD	LOD>1
98-3110K	35898	35900		5	4.27	W
98-3111K	35898	35900		5	1.5	non W
98-3112K	35898	35900		5	2.31	W
98-3113K	35898	35900		5	5.23	W
98-3114K	35898	35900		5	7.62	W
98-3115K	35898	35900		5	6.55	W
98-3116K	35898	35900		5	3.4	W
98-3117K	35898	35900		5	4.81	W
98-3118K	35898	35900		5	3.38	W
98-3119K	35899	35900		5	6.61	W
98-3120K	35899	35900		5	4.97	W
98-3121K	35899	35900		5	7.63	W
98-3122K	35899	35900		5	3.51	W
98-3123K	35899	35900		5	5.02	W
98-3124K	35899	35901		5	>2	W
98-3125K	35899	35901		5	2.04	W
98-3126K	35899	35901		5	4.92	W
98-3127K	35899	35900		5	1.54	non W
98-3128K	35899	35900		5	2.23	W
98-3129K	35899	35900		5	2.79	W
98-3130K	35899	35900		5	2.53	W
98-3131K	35899	35900		5	4.19	W
98-3132K	35899	35900		5	5.13	W
98-3133K	35899	35900		5	-2.63	non W
98-3134K	35899	35900		5	-0.46	non W
98-3135K	35899	35900		5	3.49	W
98-3136K	35899	35900		5	3.03	W
98-3137K	35899	35900		5	3.39	W
98-3138K	35902	35905		5	3.13	W
98-3139B(	35902	35905	unmarked	5	1.75	non W
98-3140B(	35905	35906	AD	5	2.43	W
98-3141B(	35905	35906	unmarked	5	4.89	W
98-3142B(	35905	35906		5	-2.05	non W
98-3143B(	35905	35906	unmarked	5	-8.41	non W
98-3144B(	35906	35907		5	-4.93	non W
98-3145B(	35906	35907	unmarked	5	-7.92	non W
98-3146B(	35907	35909	unmarked	5	-10	non W
98-3147B(	35908	35909		5	-2.77	non W
98-3148B(	35908	35909	unmarked	5	-0.83	non W
98-3149B(	35909	35912	unmarked	5	-4.18	non W
98-3150B(	35909	35912	unmarked	5	-5.75	non W
98-3151B(	35909	35912	unmarked	5	-6.32	non W
98-3152B(	35909	35912	unmarked	5	-6.08	non W
98-3153B(	35909	35912	unmarked	5	-4.67	non W
98-3154K	35909	35912		5	-3.99	non W
98-3155K	35909	35912	AD	5	6.01	W
98-3156K	35909	35912		5	1.16	non W
98-3157K	35909	35912		5	0.001	non W
98-3158K	35909	35912		5	-6.57	non W
98-3159K	35909	35912		5	-8.3	non W
98-3160K	35909	35912		5	6	W
98-3161K	35909	35912		5	1.77	non W
98-3162K	35909	35912		5	1.53	non W
98-3163B(	35912	35913	unmarked	5	-7.92	non W
98-3164B(	35912	35913		5	-4.5	non W
98-3165B(	35912	35913	unmarked	5	-3	non W
98-3166B(	35548	35916	unmarked	5	4.69	W
98-3167B(	35914	35916	unmarked	5	-8.14	non W
98-3168B(	35914	35916	AD	5	4.56	W
98-3169B(	35914	35916	unmarked	5	-2.78	non W
98-3170B(	35915	35916	unmarked	5	-4.87	non W
98-3171K	35915	35916		5	6.93	W
98-3172K	35915	35916		5	7.73	W
98-3173K	35915	35916		5	1.93	non W
98-3174K	35915	35916		5	7.37	W
98-3175K	35915	35916		5	3.25	W
98-3176K	35915	35916	AD	5	5.29	W
98-3177K	35915	35916		5	3.99	W
98-3178K	35915	35916		5	-0.1	non W
98-3179K	35915	35916		5	0.21	non W
98-3180K	35915	35916		5	6.18	W
98-3181K	35915	35916		5	5.05	W
98-3182K	35915	35916		5	3.76	W
98-3183K	35915	35916		5	3.77	W
98-3184K	35915	35916		5	-5.2	non W
98-3185K	35915	35916		5	4.96	W

Appendix C. continued

SAMPLE ID	DATE TO BML	USFWS NOTIFIE	ADIPOSE CLIP	# LOCI	LOD	LOD>1
98-3186K	35915	35916		5	-4.55	non W
98-3187K	35915	35916		5	3.13	W
98-3188K	35915	35916		5	-4.72	non W
98-3189K	35915	35916		5	-6.27	non W
98-3190K	35915	35916		5	7	W
98-3191K	35915	35916		5	6.1	W
98-3192K	35915	35916		5	1.58	non W
98-3193K	35915	35916		5	0.71	non W
98-3194K	35915	35916		5	4.35	W
98-3195K	35915	35916		5	4.66	W
98-3196B	35915	35916		5	-4.54	non W
98-3197B	35916	35919	unmarked	5	-4.03	non W
98-3198B	35916	35919	unmarked	5	-4.91	non W
98-3199B	35916	35919		5	-4.63	non W
98-3200B	35919	35921	AD	5	5.94	W
98-3201B	35919	35921	unmarked	5	-1.97	non W
98-3202B	35922	35923	AD	5	4.39	W
98-3203B	35922	35923	unmarked	5	-4.95	non W
98-3204B	35922	35923	unmarked	5	-3.64	non W
98-3205B	35923	35927	unmarked	5	-1.28	non W
98-3206K	35926	35927		5	5.28	W
98-3207K	35926	35927		5	0.06	non W
98-3208K	35926	35927		5	6.6	W
98-3209K	35929	35933		5	-4.73	non W
98-3210K	35929	35933		5	-3.58	non W
98-3211K	35929	35933		5	4.14	W
98-3212K	35929	35933		5	1.1	non W
98-3213K	35929	35933		5	3.99	W
98-3214K	35929	35933		5	5.67	W
98-3215K	35929	35933		5	6.74	W
98-3216K	35929	35933		5	2.3	W
98-3217K	35929	35933		5	2.09	W
98-3218K	35929	35933		5	1.12	non W
98-3219K	35929	35933		5	5.91	W
98-3220K	35929	35933		5	5.45	W
98-3221K	35929	35933		5	5.2	W
98-3222K	35929	35933		5	4.45	W
98-3223K	35929	35933		5	5.28	W
98-3224K	35929	35933		5	-6.66	non W
98-3225K	35929	35933		5	3.3	W
98-3226K	35929	35933		5	5.44	W
98-3227K	35929	35933		5	2.32	W
98-3228K	35929	35933		5	-4.7	non W
98-3229K	35929	35933		5	2.83	W
98-3230K	35929	35933		5	-0.25	non W
98-3231K	35929	35933		5	8.07	W
98-3232K	35929	35933		5	4.66	W
98-3233K	35929	35933		5	5.96	W
98-3234K	35929	35933		5	4.92	W
98-3235K	35929	35933		5	6.8	W
98-3236K	35929	35933		5	2.51	W
98-3237K	35929	35933		5	2.92	W
98-3238B	35936	35940	unmarked	5	-4.12	non W
98-3239B	35936	35940	AD	5	4.09	W
98-3240K	35937	35940		5	1.35	non W
98-3241K	35937	35940		5	4.66	W
98-3242K	35937	35940		5	6.02	W
98-3243K	35937	35940		5	4.75	W
98-3244K	35937	35940		5	6.65	W
98-3245K	35937	35940		5	2.37	W
98-3246K	35937	35940		5	-1.84	non W
98-3247K	35937	35940		5	-0.06	non W
98-3248K	35937	35940		5	1.8	non W
98-3249K	35937	35940		5	3.69	W
98-3250K	35937	35940		5	5.71	W
98-3251K	35937	35940		5	7.39	W
98-3252K	35937	35940		5	1.92	non W
98-3253K	35937	35940		5	0.67	non W
98-3254K	35937	35940		5	-5.75	non W
98-3255K	35937	35940		5	5.1	W
98-3256K	35937	35940		5	2.73	W
98-3257K	35937	35940		5	4.86	W
98-3258K	35937	35940	AD	5	2.86	W
98-3259K	35937	35940		5	6	W
98-3260K	35937	35940		5	4.27	W
98-3261K	35937	35940		5	3.8	W
98-3262K	35937	35940		5	7.51	W
98-3263K	35937	35940		5	2.86	W
98-3264K	35937	35940		5	7.64	W
98-3265K	35937	35940		5	0.72	non W
98-3266K	35937	35940		5	7.01	W
98-3267K	35937	35940		5	-3.97	non W
98-3281B	35943	35954	unmarked	5	6.12	W
99-3001K	36258	36259		5	7.06	W
99-3002K	36265	36266		5	7.03	W
99-3003K	36265	36266		5	-3.83	non W
99-3004K	36272	36276		7	-0.7	non W
99-3005K	36272	36273		5	-7	non W
99-3006K	36272	36273		5	5.96	W
99-3007K	36272	36273		5	2.47	W
99-3008K	36272	36273		5	5.98	W
99-3009K	36272	36273		5	2.8	W
99-3010K	36272	36273		5	3.13	W
99-3011K	36272	36273		5	4.05	W
99-3012K	36286	36287		5	5.82	W
99-3013K	36286	36287		5	-1.53	non W
99-3014K	36286	36287		5	-3.9	non W
99-3015K	36286	36287		5	-5.17	non W
99-3016K	36286	36290		7	0.7	non W
99-3017K	36286	36287		5	2.87	W
99-3018K	36286	36287		5	5.51	W
99-3019K	36286	36287		7	5.91	W
99-3020K	36286	36290		7	6	W
99-3021K	36286	36290		7	3.5	W
99-3022K	36286	36290		7	2.96	W
99-3023K	36286	36287		5	6.65	W
99-3024K	36293	36297		5	-4.69	non W
99-3025K	36293	36297		5	-5.53	non W
99-3026K	36293	36297		5	7.95	W
99-3027K	36300	36301		5	-2.61	non W
99-3028K	36300	36301		5	-3.59	non W
99-3029K	36314	36315		5	-3.49	non W
99-3030K	36314	36315		5	-4.47	non W
99-3031R	36321	36322		5	7.61	W
99-3032K	36321	36325		5	2.75	W
99-3033K	36321	36322		5	4.5	W
99-3034K	36321	36322		5	-6.21	non W
99-3035R	36328	36329		5	5.39	W
99-3036R	36328	36329		5	2.95	W
99-3037K	36328	36329		5	-1.21	non W
99-3038K	36328	36329		5	6.78	W
99-3039K	36328	36329		5	-2.9	non W
99-3040R	36329	36334		7	1.56	W
99-3041K	36335	36336		5	-4.41	non W
99-3042K	36335	36336		5	-4.36	non W
99-4001B	36231	36234		5	-3.11	non W
99-4002B	36231	36234		5	-4.19	non W
99-4003B	36231	36234		5	-4.73	non W
99-4004B	36231	36234		5	-3.71	non W
99-4005B	36234	36236		5	-4.69	non W
99-4006B	36234	36236		5	-5.35	non W
99-4007B	36235	36236		5	-4.67	non W
99-4008B	36235	36236		5	-3.52	non W
99-4009B	36235	36236		5	-1.69	non W
99-4010B	36235	36236		5	-4.47	non W
99-4011B	36235	36236		5	-4.35	non W
99-4012B	36235	36236		5	-5.96	non W
99-4013B	36235	36236		5	-4.58	non W
99-4014B	36235	36236		5	-4.43	non W
99-4015B	36235	36236		5	-3.66	non W
99-4016B	36235	36236		5	-4.38	non W
99-4017B	36235	36236		5	-3.98	non W
99-4018B	36235	36236		5	-5.63	non W
99-4019B	36235	36236		5	-2.44	non W
99-4020B	36235	36236		5	-3.85	non W
99-4021B	36235	36236		5	-3.31	non W
99-4022B	36237	36238		5	-4.44	non W
99-4023B	36237	36238		5	-5.48	non W
99-4024B	36237	36243		5	-6.02	non W
99-4025B	36237	36243		5	-2.43	non W
99-4026B	36238	36241		5	-5.49	non W
99-4027B	36238	36241		5	-4.36	non W

Appendix C. continued

SAMPLE ID	DATE TO BML	USFWS NOTIFIE	ADIPOSE CLIP	# LOCI	LOD	LOD>1
99-4028B(	36238	36241		5	-3.62	non W
99-4029B(	36238	36241		5	-3.59	non W
99-4030B(	36238	36241		5	-3.6	non W
99-4031B(	36241	36243		5	-5.84	non W
99-4032B(	36242	36243		5	-5.84	non W
99-4033B(	36242	36243		5	-5.08	non W
99-4034B(	36242	36243		5	-6.37	non W
99-4035B(	36242	36243		5	-4.99	non W
99-4036B(	36245	36248		5	-5.45	non W
99-4037B(	36245	36248		5	-5.07	non W
99-4038B(	36245	36248		5	-3.06	non W
99-4039B(	36245	36248		5	-5.02	non W
99-4040B(	36245	36248		5	-5.35	non W
99-4041B(	36245	36248		5	-4.94	non W
99-4042B(	36249	36250		5	-6.3	non W
99-4043B(	36249	36250		5	-2.49	non W
99-4044B(	36249	36250		5	-3.51	non W
99-4045B(	36249	36250		5	-5.66	non W
99-4046B(	36249	36250		5	-3.47	non W
99-4047B(	36249	36250		5	-4.16	non W
99-4048B(	36249	36250		5	-2.9	non W
99-4049B(	36249	36250		5	-2.3	non W
99-4050B(	36249	36250		5	-3.73	non W
99-4051B(	36249	36250		5	-7.03	non W
99-4052B(	36256	36259		5	-3.95	non W
99-4053B(	36257	36259		5	-1.53	non W
99-4054B(	36264	36265		5	-5.47	non W
99-4055B(	36264	36265		5	-2.75	non W
99-4056B(	36264	36265		5	-5.61	non W
99-4057B(	36265	36266		5	-3.62	non W
99-4058B(	36271	36273		5	-9.6	non W
99-4059B(	36265	36266		5	-5.6	non W
99-4060B(	36269	36270		5	-0.73	non W
99-4061B(	36270	36271		5	-5.68	non W
99-4062B(	36270	36271		5	-3.52	non W
99-4063B(	36272	36273		5	-4.42	non W
99-4064B(	36272	36273		5	-2.16	non W
99-4065B(	36277	36278		5	-7.22	non W
99-4066B(	36278	36280		5	-4.76	non W
99-4067B(	36279	36280		5	-4.28	non W
99-4068B(	36283	36284		5	-2.29	non W
99-4069B(	36290	36291		5	-3.28	non W
99-4070B(	36290	36291		5	-5.31	non W
00-2451K	36601	36602		5	3.66	W
00-2452K	36601	36602		5	5.7	W
00-2453K	36608	36609		5	7.18	W
00-2454K	36608	36609		5	-3.55	non W
00-2455K	36608	36609		5	6.9	W
00-2456K	36608	36609		5	6.82	W
00-2457K	36608	36609		5	6.98	W
00-2458K	36616	36619		5	6.58	W
00-2459K	36616	36620		7	4.18	W
00-2460K	36616	36619		5	-4.77	non W
00-2461K	36616	36619		5	-8.13	non W
00-2462K	36616	36619		5	3.85	W
00-2463K	36616	36619		5	-1.22	non W
00-2464K	36616	36619		5	-6.73	non W
00-2465K	36616	36619		5	6.88	W
00-2466K	36616	36619		5	8.46	W
00-2467K	36616	36619		5	-5.34	non W
00-2468K	36616	36619		5	4.03	W
00-2469K	36616	36619		5	3.32	W
00-2470K	36616	36619		5	6.74	W
00-2471K	36616	36619		5	-6.34	non W
00-2472K	36616	36619		5	6.4	W
00-2473K	36616	36619		5	5.32	W
00-2474K	36616	36620		7	2.89	W
00-2475K	36616	36620		7	2.58	W
00-2476K	36616	36619		5	-8.25	non W
00-2477K	36620	36622		5	-4.24	non W
00-2478K	36620	36622		5	6.18	W
00-2479K	36620	36622		5	-2.76	non W
00-2480K	36620	36622		5	-4.69	non W
00-2481K	36620	36622		5	-5.77	non W
00-2482K	36620	36622		5	-3.64	non W
00-2483K	36620	36622		5	5.37	W

SAMPLE ID	DATE TO BML	USFWS NOTIFIE	ADIPOSE CLIP	# LOCI	LOD	LOD>1
00-2484K	36620	36622		5	7.77	W
00-2485K	36623	36626		5	-6.21	non W
00-2486K	36623	36627		7	3.58	W
00-2487K	36623	36626		5	-4.39	non W
00-2488K	36623	36626		5	-4.15	non W
00-2489K	36623	36626		5	-9	non W
00-2490K	36623	36626		5	-6.01	non W
00-2491K	36623	36626		5	-3.99	non W
00-2492K	36623	36626		5	-5.75	non W
00-2493K	36623	36626		5	-4.55	non W
00-2494K	36623	36626		5	-4.85	non W
00-2495K	36623	36626		5	-6.55	non W
00-2496K	36623	36626		5	-9.33	non W
00-2497K	36629	36630		5	7.1	W
00-2498K	36629	36630	AD	5	5.35	W
00-2499K	36629	36630		5	2.67	W
00-2500K	36629	36630	AD	5	2.41	W
00-2501K	36629	36630	AD	5	2.42	W
00-2502K	36629	36630		5	5.09	W
00-2503K	36629	36630		5	5.24	W
00-2504K	36629	36630	AD	5	6.31	W
00-2505K	36629	36630		5	8.15	W
00-2506/7	36629	36633	numbering	5	6.89	W
00-2508K	36629	36630		5	8.58	W
00-2509K	36629	36633		5	-6.31	non W
00-2510K	36629	36630		5	6.89	W
00-2511K	36629	36630		5	-8.69	non W
00-2512K	36629	36630		5	-3.55	non W
00-2513K	36629	36630		5	4.04	W
00-2514K	36629	36630		5	7.86	W
00-2515K	36629	36630		5	-5.64	non W
00-2516K	36629	36633		7	3.26	W
00-2517K	36629	36630	AD	5	2.69	W
00-2518K	36629	36630	AD	5	6.27	W
00-2519K	36629	36630	AD	5	5.31	W
00-2521K	36629	36630		5	-3.26	non W
00-2522K	36629	36630		5	-6.52	non W
00-2523K	36629	36630		5	-1.3	non W
00-2524K	36629	36630		5	-3.11	non W
00-2525K	36629	36633	AD	5	3.59	W
00-2526K	36629	36630	AD	5	6.38	W
00-2527K	36635	36637		7	8.82	W
00-2528K	36635	36637		7	9.01	W
00-2529K	36635	36636		5	-5.51	non W
00-2530K	36635	36636		5	-6.93	non W
00-2531K	36635	36637	AD	7	3.11	W
00-2532K	36635	36636		5	-4.64	non W
00-2533K	36635	36636		5	-4.62	non W
00-2534K	36643	36654		5	2.73	W
00-2535K	36643	36654		5	5.42	W
00-2536K	36643	36654		5	5.8	W
00-2537K	36650	36651		5	4.54	W
00-2538K	36650	36651		5	-8.3	non W
00-2539K	36650	36651		5	6.87	W
00-2540K	36650	36651		5	3.66	W
00-2541K	36650	36651		5	6.31	W
00-2542K	36650	36651	AD	5	5.13	W
00-2543K	36650	36651		5	-5.7	non W
00-2544K	36650	36651		5	4.14	W
00-2545K	36650	36651	AD	5	2.18	W
00-2546K	36650	36651	AD	5	3.76	W
00-2547K	36650	36651		5	6.81	W
00-2548K	36650	36651		5	6.65	W
00-2549K	36650	36651		5	3.72	W
00-2550K	36657	36658	Dead Fish (Failed Extraction)			
00-2551K	36657	36661		7	2.97	W
00-2552K	36657	36658		5	4.58	W
00-2553K	36657	36658		5	-5.36	non W
00-2554K	36657	36658		5	6.98	W
00-2555K	36657	36658		5	8.6	W
00-2556K	36657	36658		5	2.73	W
00-2557K	36657	36658		5	-4.74	non W
00-2558K	36657	36658		5	2.97	W
00-2559K	36657	36658		5	7.75	W
00-2560K	36657	36658		5	7.69	W
00-2561K	36657	36658		5	-7	non W

Appendix C. continued

SAMPLE ID	DATE TO BML	USFWS NOTIFIE	ADIPOSE CLIP	# LOCI	LOD	LOD>1
00-2562K	36657	36658		5	-7.18	non W
00-2563K	36657	36658		5	4.5	W
00-2564K	36657	36658	AD	5	2.75	W
00-2565K	36657	36658		5	3.68	W
00-2566K	36657	36658		7	2.2	W
00-2567K	36657	36658		5	7.04	W
00-2568K	36657	36658		5	7.89	W
00-2569K	36657	36658		5	3.36	W
00-2570K	36657	36658		5	-1.91	non W
00-2571K	36657	36658		5	-5.94	non W
00-2572K	36657	36658		5	3.22	W
00-2573K	36657	36658		5	5.4	W
00-2574K	36657	36658		6	3.27	W
00-2575K	36657	36658		5	-2.64	non W
00-2576K	36657	36658		5	-4.09	non W
00-2577K	36657	36658		5	-3.78	non W
00-2578K	36657	36658		5	5.54	W
00-2579K	36657	36658		5	-4.04	non W
00-2580K	36664	36665		5	2.21	W
00-2581K	36664	36665		5	8.08	W
00-2582K	36664	36665		5	5.93	W
00-2583K	36669	36672		5	8.46	W
00-2584K	36669	36670		5	3.68	W
00-2585K	36671	36672		5	4.54	W
00-2586K	36671	36672		5	7.68	W
00-2587K	36671	36672		5	2.45	W
00-2588K	36671	36672		5	4.46	W
00-2589K	36671	36672		5	3.76	W
00-2590K	36672	36676		5	-5.61	non W
00-2591K	36677	36679		7	1.87	W
00-2592K	36678	36679		7	2.15	W
00-2593K	36678	36679	AD	5	7.8	W
00-2594K	36678	36679		5	4.6	W
00-2595K	36678	36679		5	6.03	W
00-2596K	36685	36686		5	3.52	W
00-2597K	36685	36686		5	2.17	W
00-2598K	36685	36686		5	3.39	W
00-2599K	36685	36686	AD	5	5.73	W
00-2600K	36686	36689		5	7.6	W
00-2601K	36692	36693	AD	5	4.03	W
00-2602K	36692	36693		5	6.42	W
00-2603K	36692	36693	AD	5	5.32	W
00-2604K	36692	36693		5	4.64	W
00-2605K	36692	36693		5	8.59	W
00-2606K	36692	36693		5	-4.1	non W
00-2607K	36692	36693		5	5.09	W
00-2608K	36699	36705		5	5.09	W
00-2609K	36699	36703		5	-5.44	non W
00-2610K	36704	36705		5	7.98	W
00-2611K	36713	36714		5	4.35	W
00-2612K	36713	36714		5	-4.04	non W
00-2613K	36713	36714		5	7.67	W
00-2614K	36713	36714		5	7.77	W
00-2615K	36713	36714		5	-4.71	non W
00-4401B(	36594	36595		5	-4.53	non W
00-4402B(	36594	36595		5	-7.46	non W
00-4403B(	36594	36595		5	-7.13	non W
00-4404B(	36595	36598		5	-3.36	non W
00-4405B(	36595	36598		5	-6.55	non W
00-4406B(	36595	36598		5	-4.8	non W
00-4407B(	36595	36598		5	-5.02	non W
00-4408B(	36598	36599		5	-4.01	non W
00-4409B(	36598	36599		5	-3.3	non W
00-4410B(	36598	36599		5	-4.64	non W
00-4411B(	36598	36599		5	-2.96	non W
00-4412B(	36598	36599		5	-3.94	non W
00-4413B(	36598	36599		5	-4.96	non W
00-4414B(	36598	36599		5	-3.85	non W
00-4415B(	36598	36599		5	-4.41	non W
00-4416B(	36598	36599	Extraction failed			
00-4417B(	36598	36599		5	-5.04	non W
00-4418B(	36598	36599		5	-4.05	non W
00-4419B(	36598	36599		5	-2.72	non W
00-4420B(	36598	36599		5	-2.72	non W
00-4421B(	36601	36602		5	-5.01	non W
00-4422B(	36599	36600		5	-5.5	non W
00-4423B(	36599	36600		5	-2.21	non W
00-4424B(	36599	36600		5	-6.32	non W
00-4425B(	36599	36600		5	-2.47	non W
00-4426B(	36599	36600		5	-4.94	non W
00-4427B(	36601	36602		5	-0.31	non W
00-4428B(	36601	36602		5	-5.24	non W
00-4429B(	36602	36605		5	-2.25	non W
00-4430B(	36602	36605		5	-4.5	non W
00-4431B(	36605	36606		5	-4.53	non W
00-4432B(	36605	36606		5	-4.56	non W
00-4433B(	36606	36607		5	-6.2	non W
00-4434B(	36606	36607		5	4.3	W
00-4435B(	36608	36609		5	-5.85	non W
00-4436B(	36609	36614		5	-1.41	non W
00-4437B(	36613	36614		5	-5.61	non W
00-4438B(	36613	36614		5	-4.89	non W
00-4439B(	36614	36615		5	-4.15	non W
00-4440B(	36614	36615		5	-3.02	non W
00-4441B(	36614	36615		5	-4.51	non W
00-4442B(	36614	36615		5	-5.59	non W
00-4443B(	36614	36615	unmarked	5	6.47	W
00-4444B(	36620	36622		5	-3.89	non W
00-4445B(	36623	36626		5	-4.63	non W
00-4446B(	36623	36626		5	-5.6	non W
00-4447B(	36627	36628		5	-4.35	non W
00-4448B(	36629	36630		5	-3.46	non W
00-4449B(	36629	36630		5	-4.72	non W
00-4450B(	36629	36630	unmarked	5	7.01	W
00-4451B(	36634	36635		5	-1.25	non W
00-4452B(	36650	36651	unmarked	5	6.75	W
00-4453B(	36651	36654		5	-2.05	non W
00-4454B(	36661	36662		5	-4.1	non W
00-4455B(	36661	36662		5	-4.39	non W
01-1801K	36951	36952	AD	7	5.3	W
01-1802K	36951	36952	AD	7	10	W
01-1803K	36951	36956	AD	7	3.1	W
01-1804K	36958	36959		5	4.1	W
01-1805K	36958	36959	AD	5	6	W
01-1806K	36958	36959	AD	5	5.7	W
01-1807K	36958	36959	AD	5	3.8	W
01-1808K	36958	36959		5	-4.7	non W
01-1809K	36965	36966		7	-6.74186	non W
01-1810K	36965	36966		7	7.11373	W
01-1811K	36965	36966	AD	7	10.041	W
01-1812K	36965	36966	AD	7	6.5358	W
01-1813K	36965	36966	AD	7	5.18041	W
01-1814K	36965	36966	AD	7	8.16861	W
01-1815K	36972	36974	AD	5	3.49541	W
01-1816K	36972	36974	AD	5	4.6096	W
01-1817K	36972	36974	AD	5	3.45611	W
01-1818K	36972	36974	AD	5	2.62677	W
01-1819K	36972	36974		5	-5.23911	non W
01-1820K	36979	36980	AD	7	9.41872	W
01-1821K	36979	36980	AD	7	5.1374	W
01-1822K	36979	36980	AD	7	5.06882	W
01-1823K	36979	36980	AD	7	7.78335	W
01-1824K	36979	36980	AD	7	4.76339	W
01-1825K	36979	36980	AD	7	7.92386	W
01-1826K	36979	36980	AD	7	8.22106	W
01-1827K	36979	36980	AD	7	7.38235	W
01-1828K	36979	36980	AD	7	3.02429	W
01-1829K	36979	36980	AD	7	6.99024	W
01-1830K	36979	36980	AD	7	7.53161	W
01-1831K	36979	36980	AD	7	6.41579	W
01-1832K	36979	36980	AD	7	9.29439	W
01-1833K	36979	36980		6	8.14317	W
01-1834K	36979	36980		7	-6.53814	non W
01-1835K	36979	36980		7	8.15759	W
01-1836K	36979	36980		7	-8.9186	non W
01-1837K	36986	36987		5	5.90781	W
01-1838K	36986	36987	AD	5	3.3487	W
01-1839K	36986	36987		5	7.79208	W
01-1840K	36986	36987	AD	5	4.52943	W
01-1841K	36986	36987	AD	5	6.3072	W
01-1842K	36986	36987	AD	5	6.00077	W
01-1843K	36986	36987	AD	5	8.70277	W

Appendix C. continued

SAMPLE ID	DATE TO BML	USFWS NOTIFIE	ADIPOSE CLIP	# LOCI	LOD	LOD>1
01-1844K	36986	36987	AD	5	4.48124	W
01-1845K	36986	36987	AD	5	7.16088	W
01-1846K	36986	36987	AD	5	4.00115	W
01-1847K	36986	36987	AD	5	3.53144	W
01-1848K	36986	36987	AD	5	2.53539	W
01-1849K	36986	36987	AD	5	7.83875	W
01-1850K	36986	36987	AD	5	2.94371	W
01-1851K	36986	36987	AD	5	2.01161	W
01-1852K	36993	36994	AD	7	5.69494	W
01-1853K	36993	36994	AD	7	6.24322	W
01-1854K	36993	36994	AD	7	9.34202	W
01-1855K	36993	36994		7	-7.34453	non W
01-1856K	37000	37001		7	8.98945	W
01-1857K	37000	37001	AD	7	2.57596	W
01-1858K	37000	37001	AD	5	4.55365	W
01-1859K	37000	37001	AD	6	6.72636	W
01-1860K	37000	37001	AD	6	5.51196	W
01-1861K	37000	37001	AD	6	8.20376	W
01-1862K	37000	37001	AD	6	6.55774	W
01-1863K	37007	37008	AD	7	10.4901	W
01-1864K	37014	37015	AD	7	8.57	W
01-1865K	37014	37015	AD	6	5.4	W
01-1866K	37014	37015		6	3.7	W
01-1867K	37020	37021		7	6.53737	W
01-1868K	37020	37021		7	7.1587	W
01-1869K	37020	37021		7	-10.247	non W
01-1870K	37020	37021	AD	7	7.47207	W
01-1871K	37020	37021	AD	7	9.91344	W
01-1872K	37027	37028		7	10.35	W
01-1873K	37027	37028		7	8.57	W
01-1874K	37027	37028	AD	7	6.6	W
01-1875K	37027	37028	AD	7	8.75	W
01-1876K	37027	37028	AD	7	5.97	W
01-1877K	37027	37028		6	8.21	W
01-1878K	37027	37028	AD	7	10.45	W
01-1879R	37035	37039		7	-6.30278	non W
01-1880K	37035	37039	AD	7	5.89791	W
01-1881K	37035	37039		7	8.28986	W
01-1882K	37035	37039	AD	7	6.7358	W
01-1883K	37035	37039	AD	7	6.14517	W
01-1884K	37035	37039		7	-6.41587	non W
01-1885K	37035	37039		7	2.12491	W
01-1886K	37035	37039		7	5.94711	W
01-1887K	37035	37039		7	4.38741	W
01-1888K	37035	37039	AD	7	7.34199	W
01-1889K	37042	37043		7	5.82767	W
01-1890K	37042	37043		7	-4.66483	non W
01-1891K	37042	37043		7	8.3787	W
01-1892K	37042	37043		7	9.3832	W
01-1893K	37042	37043		7	-5.55452	non W
01-1894K	37042	37043	AD	7	5.10246	W
01-1895K	37042	37043	AD	7	7.3562	W
01-1896K	37042	37043		7	3.69855	W
01-1897K	37042	37043		7	9.51981	W
01-1898K	37042	37043		7	6.22618	W
01-1899K	37042	37043		7	6.09761	W
01-1900K	37042	37043		7	-4.71861	non W
01-1901K	37042	37043		7	4.59056	W
01-1902K	37042	37043		7	6.20614	W
01-1903K	37042	37043		7	6.39098	W
01-1904K	37042	37043		7	7.72735	W
01-1905R	37042	37043		7	-5.43296	non W
01-1906R	37042	37043		7	-4.97371	non W
01-1907R	37042	37043		7	-5.5617	non W
01-1908R	37042	37043		7	4.44295	W
01-1909	37047	37048		7	-6.33178	non W
01-1910K	37049	37053		7	3.98	W
01-1911K	37049	37053		7	-3.63	non W
01-1912K	37049	37053		7	4.52	W
01-1913K	37049	37053	AD	7	8.25	W
01-1914K	37049	37053	AD	7	7.54	W
01-1915K	37049	37053		7	7.23	W
01-1916K	37049	37053		7	2.75	W
01-1917K	37049	37053	AD	7	8.75	W
01-1918K	37049	37053	AD	7	7.73	W
01-1919K	37049	37053		7	0.688286	non W
01-1920K	37049	37053	AD	7	7.94	W
01-1921K	37049	37053		7	-2.25	non W
01-1922K	37049	37053	AD	7	8.04	W
01-1923K	37049	37053	AD	7	4.98	W
01-1924K	37049	37053	AD	7	6.88	W
01-1925K	37049	37053		7	2.38	W
01-1926K	37049	37053	AD	7	3.17	W
01-1927K	37049	37053	AD	7	7.47	W
01-1928K	37049	37053	AD	7	7.21	W
01-1929K	37049	37053		7	9.32	W
01-1930K	37049	37053		7	5.99	W
01-1931K	37049	37053		7	7.52	W
01-1932K	37049	37053		7	4.36	W
01-1933K	37049	37053		7	8.24	W
01-1934K	37049	37053		7	4.53733	W
01-1935K	37049	37053	AD	7	10.08	W
01-1936K	37049	37053	AD	6	8.26	W
01-1937K	37049	37053	AD	7	8.8	W
01-1938K	37049	37053		7	-6.48564	non W
01-1939K	37049	37053	AD	7	4.32	W
01-1940K	37049	37053		7	5.35	W
01-1941K	37049	37053		7	1.0248	W
01-1942K	37049	37053	AD	7	5.12	W
01-1943K	37049	37053	AD	7	6.44	W
01-1944K	37049	37053		7	4.18	W
01-1945K	37049	37053		7	-7.74	non W
01-1946K	37049	37053		7	-5.67	non W
01-1947K	37049	37053		7	4.27	W
01-1948K	37049	37053		7	2.86	W
01-1949K	37049	37053		7	8.75	W
01-1950K	37049	37053		7	8.95337	W
01-1951K	37056	37060		7	9.54665	W
01-1952K	37056	37060		7	7.60106	W
01-1953K	37056	37060		7	8.41841	W
01-1954K	37056	37060		7	7.41965	W
01-1955K	37056	37060		7	2.78494	W
01-1956K	37056	37060		7	4.42323	W
01-1957K	37056	37060		7	9.10936	W
01-1958K	37056	37060		7	7.15377	W
01-1959K	37056	37060		6	7.96923	W
01-1960K	37056	37060		7	8.4929	W
01-1961K	37056	37060		7	9.67811	W
01-1962K	37056	37060		7	2.96817	W
01-1963K	37056	37060		7	2.71883	W
01-1964K	37056	37060		7	4.18287	W
01-1965K	37056	37060		7	4.63354	W
01-1966K	37056	37060		7	10.1615	W
01-1967K	37056	37060		5	3.45965	W
01-1968K	37056	37060		7	4.91893	W
01-1969K	37056	37060		7	7.79824	W
01-1970K	37056	37060		7	5.0943	W
01-1971K	37056	37060		5	6.72057	W
01-1972K	37056	37062		7	-1.70438	non W
01-1973K	37056	37060		7	8.16835	W
01-1974K	37056	37060		7	9.4856	W
01-1975K	37056	37060		7	4.80098	W
01-1976K	37056	37060		7	4.4193	W
01-1977K	37056	37060		7	6.55348	W
01-1978K	37056	37060		7	7.31499	W
01-1979K	37056	37060		7	1.11092	W
01-1980K	37056	37060	AD	7	6.93415	W
01-1981K	37056	37060		7	6.0272	W
01-1982K	37056	37060		7	3.58822	W
01-1983K	37056	37060		7	8.50384	W
01-1984K	37056	37060		7	7.26961	W
01-1985K	37056	37060		7	6.36866	W
01-1986K	37056	37060		7	6.85685	W
01-1987K	37056	37060		7	5.68158	W
01-1988K	37056	37060		7	7.7617	W
01-1989K	37056	37060		7	7.6792	W
01-1990K	37056	37060		7	5.71191	W
01-1991K	37056	37060		7	1.56316	W
01-1992K	37056	37060		7	0.044746	non W
01-1993K	37056	37060		7	8.82826	W
01-1994K	37056	37060		7	5.41369	W
01-1995K	37056	37060		7	8.84796	W