

Summary of Coded Wire Tag Recovery Data for Hatchery and Naturally Reared Chinook Salmon in the Mokelumne River during Return-Years 2002 and 2004

Coded wire tagging (CWT) is routinely used to identify groups or populations of salmon. Data on tagged fish recoveries for return-years 2002 and 2004 were obtained from the Pacific States Marine Fisheries Commission’s Regional Marking Information System. The recoveries and straying rates summarized below track the movement of fall-run Chinook salmon reared in the Mokelumne River Fish Hatchery and produced naturally within the lower Mokelumne River.

Release locations for hatchery reared Chinook salmon include sites within the Sacramento River, Mokelumne River, San Joaquin River, the Sacramento-San Joaquin Delta, and the San Francisco Bay. Naturally produced Chinook salmon were captured during annual rotary screw trap outmigration monitoring located below the Woodbridge Irrigation District Dam at River km 63. Fish were tagged and marked onsite and released immediately downstream. All CWT recoveries for return-years 2002 and 2004 consist of Mokelumne River brood stock origin.

Analysis of escapement and straying rates were generated from CWT recoveries from a variety of fishery groups. Table 1 and Table 2 summarize recoveries based on fishery for both hatchery produced and naturally produced Mokelumne River fall-run Chinook salmon during return-years 2002 and 2004. Carcass surveys were first conducted on the Mokelumne River during the 2003 spawner season. As such, spawning ground recoveries for return-year 2002 do not include CWT recoveries from the Mokelumne River.

Table 1 2002 Mokelumne River Fall-Run Chinook Salmon CWT Estimated Recoveries by Fishery

Fishery	Hatchery Production	Natural Production	Sum of Estimated Recoveries
ocean troll	4137	5	4142
treaty troll	13	0	13
ocean sport	1552	7	1559
sport (charter)	70	3	73
sport (private)	74	1	75
freshwater sport	1229	0	1229
hatchery	1290	6	1296
spawning ground ¹	1249	3	1252
hake trawl fishery	8	0	8
Totals=			9647

¹ Spawning ground recoveries do not include Mokelumne River data. Carcass surveys were first conducted on the Mokelumne River in 2003.

Table 2 2004 Mokelumne River Fall-Run Chinook Salmon CWT Estimated Recoveries by Fishery

Fishery	Hatchery Production	Natural Production	Sum of Estimated Recoveries
ocean troll	6620	4	6624
treaty troll	38	0	38
ocean sport	2673	0	2673
sport (charter)	39	0	39
sport (private)	54	0	54
estuary sport	14	0	14
hatchery	1082	4	1086
spawning ground	1069	5	1074
Total=			11,602

Table 3 and Table 4 summarize CWT hatchery recoveries of Mokelumne River fall-run Chinook salmon. In 2002, 73.76% of the estimated Mokelumne River Chinook salmon CWT recoveries occurred at the Mokelumne River Fish Hatchery. In 2004, 63.72% were recovered at the Mokelumne River Fish Hatchery.

Table 3 2002 Mokelumne River Chinook Salmon CWT Estimated Hatchery Recoveries

Hatchery	Hatchery Production	Natural Production	Sum of Estimated Recoveries	%
COLEMAN NFH	5	0	5	0.39
FEATHER R HATCHERY	16	0	16	1.24
NIMBUS FISH HATCHERY	219	1	220	16.99
MOKELUMNE RIVER	951	5	956	73.76
MERCED R FISH FACIL.	99	0	99	7.64
Total=			1296	100%

Table 4 2004 Mokelumne River Chinook Salmon CWT Estimated Hatchery Recoveries

Hatchery	Hatchery Production	Natural Production	Sum of Estimated Recoveries	%
COLEMAN NFH	5	0	5	0.46
FEATHER R HATCHERY	4	0	4	0.37
NIMBUS FISH HATCHERY	340	0	340	31.31
MOKELUMNE RIVER	688	4	692	63.72
MERCED R FISH FACIL.	45	0	45	4.14
Total=			1086	100%

In 2002, a majority (51.14%) of the spawning ground recoveries were captured in the Merced River (Table 5). Unfortunately, there were no CWT recoveries in the Mokelumne River in 2002 to compare to this data. Carcass surveys in the Mokelumne River were first conducted in the fall of 2003. In 2004, a majority (56.89%) of the spawning ground recoveries occurred in the American River. Mokelumne River CWT recoveries accounted for 7.17% of the 2004 total estimated spawning ground recoveries (Table 6).

Table 5 2002 Mokelumne River Chinook Salmon CWT Estimated Spawning Ground Recoveries

Spawning Grounds	Hatchery Production	Natural Production	Sum of Estimated Recoveries	%
BATTLE CREEK	-	-	-	-
CLEAR CREEK	8	-	8	0.67
ABOVE RED BLUFF DAM	30	-	30	2.41
MILL CR-SACRMEN. R.	11	-	11	0.89
BUTTE CREEK	15	-	15	1.20
FEATHER RIVER HIGH FLOW AREA	24	-	24	1.91
FEATHER RIVER LOW FLOW AREA	16	-	16	1.31
YUBA RIVER	32	-	32	2.56
AMERICAN RIVER	108	3	111	8.82
COSUMNES RIVER	-	-	-	-
MOKELUMNE RIVER ¹	-	-	-	-
STANISLAUS RIVER	227	-	227	18.12
TUOLUMNE RIVER	137	-	137	10.97
MERCED RIVER	640	-	640	51.14
		Total=	1252	100%

¹ Spawning ground recoveries do not include Mokelumne River data.

Table 6 2004 Mokelumne River Chinook Salmon CWT Estimated Spawning Ground Recoveries

Spawning Grounds	Hatchery Production	Natural Production	Sum of Estimated Recoveries	%
BATTLE CREEK	17	-	17	1.58
CLEAR CREEK	2	-	2	0.19
ABOVE RED BLUFF DAM	58	-	58	5.40
MILL CR-SACRMEN. R.	3	-	3	0.28
BUTTE CREEK	14	-	14	1.30
FEATHER RIVER HIGH FLOW AREA	-	-	-	-
FEATHER RIVER LOW FLOW AREA	13	-	13	1.21
YUBA RIVER	77	-	78	7.26
AMERICAN RIVER	611	-	611	56.89
COSUMNES RIVER	19	-	19	1.77
MOKELUMNE RIVER	71	5	77	7.17
STANISLAUS RIVER	87	-	87	8.10
TUOLUMNE RIVER	31	-	31	2.89
MERCED RIVER	64	-	64	5.96
		Total=	1074	100%

In 2002, straying rates (escapement to rivers other than the Mokelumne River) ranged from 6.59% from releases in the South Fork of the Mokelumne River to 96.49% from releases at Crockett and the San Pablo Bay net pens at Wickland Oil (Table 7). Naturally produced fall-run Chinook salmon released at Woodbridge had a 44.44% straying rate in 2002. In 2004, straying rates ranged from 0% with all ten naturally produced Chinook recoveries occurring in the Mokelumne River to 94.87% from releases in West Sacramento.

Table 7 2002 Comparison of Release Strategies on Escapement CWT Recoveries and Straying Rates

Stock	Release Location	Mokelumne River Recoveries	Recoveries in Other Rivers	Straying Rate (%)
Wild	WOODBIDGE	5	4	44.44
MOKE	MOKELUMNE R, MOUTH	58	92	61.33
MOKE	NEW HOPE LANDING	464	215	31.66
MOKE	NORTH FORK MOKELUMNE	88	7	7.37
MOKE	SOUTH FORK MOKELUMNE	85	6	6.59
MOKE	JERSEY PT,SAN JOAQ.R	112	165	59.57
MOKE	SHERMAN ISL OP JERSY	122	890	87.95
MOKE	CROCKETT	1	24	96
MOKE	WEST SACRAMENTO	17	66	79.52
MOKE	WICKLAND OIL NET PEN	4	110	96.49
MOKE	BENICIA	-	13	100

Table 8 2004 Comparison of Release Strategies on Escapement CWT Recoveries and Straying Rates

Stock	Release Location	Mokelumne River Recoveries	Recoveries in Other Rivers	Straying Rate (%)
Wild	WOODBIDGE	10	0	0
MOKE	MOKELUMNE R FISH INS	192	36	15.79
MOKE	BEAN FARM	190	58	23.39
MOKE	NEW HOPE LANDING	104	162	60.90
MOKE	NORTH FORK MOKELUMNE	35	103	74.64
MOKE	SOUTH FORK MOKELUMNE	4	19	83.04
MOKE	MOUTH OF BEAVER SL.	28	3	9.68
MOKE	MOKE R., STATEN ISL.	61	117	65.73
MOKE	STATEN ISL, T&M RANCH	60	30	33.33
MOKE	JERSEY PT,SAN JOAQ.R	42	413	90.77
MOKE	SHERMAN ISL OP JERSY	41	411	90.93
MOKE	WEST SACRAMENTO	2	37	94.87
MOKE	BENICIA	-	2	100

Coded wire tag recoveries can also be used to examine the effects of various release strategies on survival to adult. Percent survival is generated by dividing the total estimated number of CWT recoveries by the total number of CWT fish released for each release location. Adult CWT recoveries incorporated into the percent survival include both ocean and inland recoveries. In 2002 percent survival ranged from 0.08% from releases at Benicia to 2.42% from releases at the mouth of the Mokelumne River

(Table 9). In 2004 percent survival ranged from 0.04% from releases at the South Fork of the Mokelumne River to 3.09% from releases at Sherman Island opposite Jersey Point.

Table 9 2002 Percent Survival

Release Location	Averaged % Survival
WOODBIDGE	0.14
MOKELUMNE R, MOUTH	2.42
NEW HOPE LANDING	0.34
NORTH FORK MOKELUMNE	0.2
SOUTH FORK MOKELUMNE	0.09
JERSEY PT, SAN JOAQ.R	0.55
SHERMAN ISL OP JERSY	1.18
CROCKETT	0.32
WEST SACRAMENTO	0.24
WICKLAND OIL NET PEN	0.97
BENICIA	0.08

Table 10 2004 Percent Survival

Release Location	Averaged % Survival
WOODBIDGE	0.09
MOKELUMNE R FISH INS	0.43
BEAN FARM	0.6
NEW HOPE LANDING	0.16
NORTH FORK MOKELUMNE	0.29
SOUTH FORK MOKELUMNE	0.04
MOUTH OF BEAVER SL.	0.49
MOKE R., STATEN ISL.	1.08
STATEN ISL, T&M RANCH	1.31
JERSEY PT, SAN JOAQ.R	1.6
SHERMAN ISL OP JERSY	3.09
WEST SACRAMENTO	0.15
BENICIA	0.09

Results indicate that certain hatchery strategies may influence straying rates and survival. In addition water year type may directly influence return rates and escapement to the Mokelumne River.