

Thermal mark patterns Applied to Salmon from Alaska, Washington, Treaty Tribes and Other Northwest States for Brood Year 2001

Beverly A. Agler
Dion S. Oxman
Alaska Department of Fish and Game
P.O. Box 25526
Juneau, Alaska 99821-5526

Peter T. Hagen
National Marine Fisheries Service
11305 Glacier Highway
Juneau, Alaska 99801-8626

Eric C. Volk
Jeff J. Grimm
Washington Dept of Fish and Wildlife
600 Capitol Way N.
Olympia, WA 98501

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Abstract

In Washington and Alaska, mass-marking of salmon using otolith thermal marking is an effective research and management tool for a variety of situations. The specific needs and applications for marking, however, are not same in each state. This document contains a report of thermal mark patterns applied to salmon stocks from the 2001 brood year. It includes release numbers where known and mark patterns applied in Alaska, Washington, Oregon and by Treaty Tribes.

Summary of Alaska Thermal Marking Programs

In Alaska, thermal marking is primarily used to provide information about the contribution of hatchery fish, primarily pink, chum and sockeye salmon, to commercial and cost-recovery fisheries during the summer fishing season. In addition, several on-going programs use this information to aid in the in-season management of mixed stock fisheries. Hatcheries use mark recovery data to evaluate the success of various release strategies. In research applications, thermal marks have been used to answer questions regarding lake survival and straying rates of returning adults. The presence of otolith thermal marks are also being used to determine the origin of juvenile and immature salmon collected during biotic surveys in the Gulf of Alaska. In many instances, thermal marks are being applied by hatcheries in the absence of a directed sampling program. This applies primarily to coho and chinook salmon, but it includes some sockeye releases as well. The reasons for this vary, but it primarily occurs in situations where the marks cost little to apply and there is anticipation that a thermal mark recovery program will be implemented by the time the fish return.

Thermal mark patterns are assigned annually by the Alaska Department of Fish and Game with consideration based on the constraints of the hatchery, the management's need to identify specific stocks, and the existence of a funded program to recover and identify the thermal patterns. Because thermal marking programs are expected to expand over the next couple of years, it is becoming increasingly difficult to create and apply unique patterns. Consequently, alternative marking strategies, such as the use of strontium chloride, are currently being explored.

A list of thermal marks applied to hatchery-reared salmon during brood year 2001 is provided in Table 1. Although final release estimates had not been reported by all the hatchery operations as of this date, there were a total of 65 different mark groups. To date, more than 500 million marked fish have been released. Strontium marking continued for the third year at Gulkana Hatchery on sockeye, and a new program was initiated to thermal mark chum salmon in the Southeast region at Neets Bay.

The otolith pattern is presented both as the RBr notation (Munk and Geiger 1998) with slight modifications by Hagen (1999), as well as the equivalent Hatch Notation. The Hatch Notation is similar to the RBr code in that thermal rings are grouped into bands of rings that are evenly spaced. The primary difference is that the hatch event is denoted with an 'H,' and the position of the 'H' in the code indicates what rings are formed pre- or post-hatch. Both notations are shown as well as a graphic representation of the mark.

Information regarding thermal marked patterns and numbers of released fish in Alaska is available from the Alaska Department of Fish and Game, Mark, Tag and Age Laboratory database.

Summary of Otolith Thermal Marking Projects by The Washington State Department of Fish and Wildlife, Northwest Treaty Tribes and other Western States.

In Washington State, mass-marking of hatchery salmon with thermally-induced otolith marks (Volk et al. 1999) is primarily used as an evaluation and research tool where identification of hatchery fish at various life history stages is important. Projects range widely in scope and magnitude, including evaluation of supplementation efforts for stock recovery, assessment of survival rates for different hatchery release strategies, determination of hatchery stray rates and evaluating impacts of hatchery programs on wild stocks. On a more limited scale, thermal marking is also used as an aid to pre-season and in-season management of near-terminal fisheries. WDF&W often acts as a consultant to other Western U.S. fisheries agencies using otolith thermal marking. Where information is available, these projects are included in this summary.

A summary of otolith thermal marks applied to BY 2001 salmon in Washington State (WDF&W and State treaty tribes), Oregon and other western states is presented in Table 2. A total of 27 initiatives are summarized where more than 30 million juvenile salmon were mass-marked with thermally-induced patterns. Because the large majority of these projects are focused upon evaluation or research objectives, it is typical to have unique identifiers for many groups within a single stock. Similarly, because marks in these studies are typically recovered from juveniles or adults in or near their river of origin, duplicate marks between stocks are not a large problem and redundancy of marks between stocks occurs. Where possible, this duplication was avoided.

A growing use of otolith thermal marking in Washington is for evaluating the success of stock recovery efforts, particularly with chum and coho salmon. In many of these cases, eyed-eggs are placed in remote site incubators for volitional exit and thermal marking is the only way to place an identifier on these groups. Another growing application of thermal marking in Washington is to evaluate the impact of hatchery fish on wild fish in natural spawning areas. Nearly all thermal-marking efforts are conducted by chilling ambient incubation water and patterns are typically created using a modified bar code symbology (Volk et al. 1994). Pre-hatch marks are often used as brood year identifiers. The large diversity of marking site attributes among these efforts has demanded innovation and adaptation to achieve the required temperature differences to mark fish. In Table 2, the BY 2001 mark patterns are represented as a schematic of thermal events. For consistency, these patterns described according to the Hatch Code scheme.

We expect that thermal marking efforts will continue at a similar or slightly increased level next year. However, there is a possibility that in the near future, thermal marking may expand significantly in Washington State and Oregon as pressure mounts to unequivocally identify hatchery fish amidst concern over declining wild stocks.

References

- Hagen, P. 1999. A modeling approach to address the underlying structure and constraints of thermal mark codes and code notation. (NPAFC Doc. 395). 12 p. Alaska Dept. Fish and Game, Juneau Alaska.
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Table 1. Summary of thermal mark codes applied to Alaska hatchery salmon in brood year 2001.

SPECIES: CHINOOK

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK01-01	TM	2001	2002		CHINOOK	Alaska	Southcentral	ADFG	Fort Rich	Ninilchik Cr
AK01-02	TM	2001	2002		CHINOOK	Alaska	Southcentral	ADFG	Elmendorf	Elkutna Cr
AK01-03	IM	2001	2002		CHINOOK	Alaska	Southcentral	ADFG	Fort Rich	Crooked Cr
AK01-04	TM	2001	2002		CHINOOK	Alaska	Southcentral	ADFG	Elmendorf	Kachemak Cr
AK01-05	IM	2001	2002		CHINOOK	Alaska	Southcentral	ADFG	Elmendorf	Ship Cr
AK01-06	TM	2001	2002		CHINOOK	Alaska	Southcentral	ADFG	Elmendorf	Crooked Cr
AK01-07	TM	2001	2002		CHINOOK	Alaska	Southcentral	ADFG	Fort Rich	Deception Cr
AK01-08	IM	2001	2002		CHINOOK	Alaska	Southcentral	ADFG	Elmendorf	Ressurrection Bay
AK01-09	TM	2001	2002		CHINOOK	Alaska	Southeast	NSRAA	Medvejie	Medvejie
AK01-10	TM	2001	2002		CHINOOK	Alaska	Southeast	NSRAA	Hidden Falls CIF	Hidden Falls
AK01-11	TM	2001	2002		CHINOOK	Alaska	Southeast	NSRAA	Medvejie	Medvejie
AK01-12	TM	2001	2003		CHINOOK	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau

ID#	MARK NAME	STAGE	WEIGHT	LENGTH	ESIMATED RELEASE	RBr CODE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	COMMENTS
AK01-01	NINILCHIK01CHIN		54,631			1:1.2.2.3	2,3H			
AK01-02	EKLUTNA01CHIN		106,991			1:1.2.2.3+3.3	2,3H3			
AK01-03	PWS01CHIN		327,280			1:1.2.2.4	2,4H			
AK01-04	KACHEMAK01CHIN		379,350			1:1.2.2.4+3.3	2,4H3			
AK01-05	SHIPCR01CHIN		290,501			1:1.2.2.4+3.4	2,4H4			
AK01-06	CROOKEDCR01CHIN		98,453			1:1.2.2.4+3.5	2,4H4			
AK01-07	DECEPTIONCR01CHIN		197,277			1:1.2.2.5	2,5H			
AK01-08	RESSURECTION01CHIN		193,610			1:1.2.2.5+3.3	2,5H3			
AK01-09	GREENLK01CHIN					1:1.3.2.3	3,3H			
AK01-10	KASNYKYU01CHIN					1:1.4.2.2	4,2H			
AK01-11	MEDVEJIE01CHIN					1:1.4.2.3	4,3H			
AK01-12	GASTINEAU01CHIN		600,000			2:1.4	H4			

SPECIES: COHO

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK01-25	TM	2001	2001		COHO	Alaska	Southcentral	CIAA	Trail Lakes	Bear Lk
AK01-26	TM	2001	2002		COHO	Alaska	Southcentral	CIAA	Trail Lakes	Bear Lk
AK01-27	IM	2001	2003		COHO	Alaska	Southcentral	PWSAC	Ily H.Noerenberg Hatct	Wally Noerenberg
AK01-28	TM	2001			COHO	Alaska	Southeast	NSRAA	Medvejie	Medvejie
AK01-29	IM	2000	2002		COHO	Alaska	Southcentral	ADFG	Fort Rich	Bear Lk
AK01-30	TM	2001	2003		COHO	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau
AK01-31	TM	2001			COHO	Alaska	Southeast	Port Armstrong	Port Armstrong	Port Armstrong
AK01-32	IM	2000	2002		COHO	Alaska	Southcentral	ADFG	Fort Rich	Ship & Jim Cr
AK01-33	TM	2000	2002		COHO	Alaska	Southcentral	VFDA	Solomon Gulch Hatcher	Solomon Gulch

ID#	MARK NAME	STAGE	WEIGHT	LENGTH	ESIMATED RELEASE	RBr CODE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	COMMENTS
AK01-25	BEARLK01COHO		528,500			1:1.3.2.3	3,3H			
AK01-26	BEARLK01WEIRCOHO		150,000			1:1.3.2.3+3.2	3,3H2			
AK01-27	WHN01COHO					1:1.3	3H			
AK01-28	DEERLK01COHO					1:1.4.2.2	4,2H			
AK01-29	RESSURECTION01COHO		241,255			1:1.4	4H			
AK01-30	GASTINEAU01COHO		800,000			1:1.4	4H			
AK01-31	PORTARMSTRONG01COHO		1,468,761			1:1.4	4H			
AK01-32	COOKINLET01COHO		610,946			1:1.5	5H			
AK01-33	SOLOMONGULCH01COHO		1,841,889			1:1.6	6H			

Table 1 (continued). Summary of thermal mark codes applied to Alaska hatchery salmon in brood year 2001.

SPECIES: SOCKEYE

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK01-47	TM	2001	2001		SOCKEYE	Alaska	Southeast	SSRAA	Burnett Inlet	Hugh Smith Lk
AK01-48	TM	2001	2001		SOCKEYE	Alaska	Southeast	SSRAA	Burnett Inlet	Hugh Smith Lk
AK01-49	TM	2001	2002		SOCKEYE	Alaska	Southeast	POWHA	Klawock	Klawock Lk
AK01-50	TM	2001	2003		SOCKEYE	Alaska	Southeast	DIPAC	Snettisham CIF	Snettisham
AK01-51	TM	2001	2001		SOCKEYE	Alaska	Southcentral	CIAA	Trail Lakes	Tutsumena Lk
AK01-52	TM	2001	2003		SOCKEYE	Alaska	Southcentral	PWSAC	Main Bay Hatchery	Main Bay
AK01-53	TM	2001	2003		SOCKEYE	Alaska	Southeast	DIPAC	Snettisham CIF	Snettisham
AK01-54	TM	2001	2002		SOCKEYE	Alaska	Southeast	SSRAA	Burnett Inlet	McDonald Lk
AK01-55	TM	2001	2001		SOCKEYE	Alaska	Southcentral	CIAA	Trail Lakes	Hidden Lake
AK01-56	TM	2001	2003		SOCKEYE	Alaska	Southeast	DIPAC	Snettisham CIF	Snettisham
AK01-57	TM	2001	2003		SOCKEYE	Alaska	Southeast	DIPAC	Snettisham CIF	Snettisham
AK01-58	TM	2001	2002		SOCKEYE	Alaska	Southeast	DIPAC	Snettisham CIF	Snettisham
AK01-59	TM	2001	2001		SOCKEYE	Alaska	Southcentral	CIAA	Trail Lakes	Bear Lk
AK01-60	TM	2001	2001		SOCKEYE	Alaska	Southcentral	CIAA	Trail Lakes	Bear Lk
AK01-61	TM	2001	2001		SOCKEYE	Alaska	Southcentral	CIAA	Trail Lakes	Bear Lk
AK01-62	TM	2001	2001		SOCKEYE	Alaska	Southcentral	CIAA	Trail Lakes	Big Lk
AK01-63	TM	2001	2002		SOCKEYE	Alaska	Southeast	DIPAC	Snettisham CIF	Tatsamenie Lk
AK01-64	TM	2001	2002		SOCKEYE	Alaska	Southeast	DIPAC	Snettisham CIF	Tatsamenie Lk
AK01-65	TM	2001	2002		SOCKEYE	Alaska	Southeast	DIPAC	Snettisham CIF	Tahltan Lk

ID#	MARK NAME	STAGE	WEIGHT	LENGTH	ESIMATED RELEASE	RBr CODE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	COMMENTS
AK01-47	HUGHSMITH01L/LSOCK	Late / Large				1:1.2,2.3,3.2	2,3,2H			
AK01-48	HUGHSMITH01E/SSOCK	Early / Small				1:1.2,2.3,3.3	2,3,3H			
AK01-49	KLAWOCK01SOCK		510,140			1:1.3,2.2	3,2H			
AK01-50	SPEELARM01E/LSOCK	Early / Large				1:1.3,2.3	3,3H			
AK01-51	TUTSTUMENA01SOCK		9,893,200			1:1.3,2.3	3,3H			
AK01-52	MAINBAY01SOCK					1:1.3,2.3+3.2	3,3H2			
AK01-53	SPEELARM01L/LSOCK	Late / Large				1:1.3,2.4n	3,4nH			
AK01-54	NECKCR01SOCK		461,000			1:1.3,2.5n	3,5n			
AK01-55	HIDDENLK01SOCK		980,100			1:1.4,2.2	4,2H			
AK01-56	SPEELARM01L/SSOCK	Late / Small				1:1.4,2.3n	4,3nH			
AK01-57	SPEELARM01E/SSOCK	Early / Small				1:1.4,2.4	4,4H			
AK01-58	SWEETHEART01SOCK		510,062			1:1.5,2.3n	5,3nH			
AK01-59	BEARLK01PRESMOLTSOCK	Presmolt	700,000			1:1.6,2.3	6,3H			
AK01-60	BEARLK01SMOLTSOCK	Smolt				1:1.6,2.3+3.3	6,3H3			
AK01-61	BEARLK01FRYSOCK	Fry	2,407,700			1:1.6	6H			
AK01-62	BIGLK01SOCK		4,315,900			2:1.3	H3			
AK01-63	TATSAMENIE01UNFEDSOCK	Early unfed	727,425			2:1.5	H5			
AK01-64	TATSAMENIE01FEDSOCK	Early Fed	1,505,775			2:1.5,2.3	H5,3			
AK01-65	TAHLTAN01SOCK		2,532,920			2:1.6	H6			

Table 1 (continued). Summary of thermal mark codes applied to Alaska hatchery salmon in brood year 2001.

SPECIES: CHUM

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK01-13	TM	2001	2002		CHUM	Alaska	Southeast	NSRAA	Hidden Falls CIF	Hidden Falls
AK01-14	TM	2001	2002		CHUM	Alaska	Southeast	NSRAA	Hidden Falls CIF	Hidden Falls
AK01-15	TM	2001	2002		CHUM	Alaska	Southcentral	PWSAC	Wally H.Noerenberg Hatchery	Wally Noerenberg
AK01-16	TM	2001	2002		CHUM	Alaska	Southcentral	PWSAC	Wally H.Noerenberg Hatchery	Wally Noerenberg
AK01-17	TM	2001	2002		CHUM	Alaska	Southeast	NSRAA	Hidden Falls CIF	Hidden Falls
AK01-18	TM	2001	2002		CHUM	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau
AK01-19	TM	2001	2002		CHUM	Alaska	Southeast	NSRAA	Hidden Falls CIF	Hidden Falls
AK01-20	TM	2001	2002		CHUM	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau
AK01-21	TM	2001	2002		CHUM	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau
AK01-22	TM	2001	2002		CHUM	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau
AK01-23	TM	2001	2002		CHUM	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau
AK01-24	TM	2001	2002		CHUM	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau

ID#	MARK NAME	STAGE	WEIGHT	LENGTH	ESIMATED RELEASE	RBr CODE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	COMMENTS
AK01-13	TAKATZ01CHUM				36,316,937	1:1.3,2,2	3,2H			
AK01-14	KASNYKU01CHUM				36,503,940	1:1.3,2,3	3,3H			
AK01-15	WHN01CHUM					1:1.3,2,3	3,3H			
AK01-16	PORTCHALMER01CHUM					1:1.3	3H			
AK01-17	DEEPINLET01CHUM				14,000,000	1:1.4,2,3	4,3H			
AK01-18	AMALGA01CHUM				40,000,000	1:1.4	4H			
AK01-19	KAKE01CHUM					1:1.4+2.2	4H2			
AK01-20	GASTINEAU01CHUM				37,000,000	1:1.4+2.3	4H3			
AK01-21	GASTINEAU01L/LCHUM	Late / Large				1:1.4+2.3,3.3	4H3,3			
AK01-22	BOATHARBOR01CHUM				15,000,000	1:1.4+2.4	4H4			
AK01-23	LIMESTONE01CHUM				15,000,000	1:1.4+2.5	4H5			
AK01-24	AMALGA01L/LCHUM	Late / Large			8,000,000	1:1.4+2.6	4H6			

Table 1 (continued). Summary of thermal mark codes applied to Alaska hatchery salmon in brood year 2001.

SPECIES: PINKS

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK01-34	TM	2001	2001		PINK	Alaska	Southcentral	Port Graham	Port Graham	Port Graham
AK01-35	TM	2000	2001		PINK	Alaska	Southcentral	PWSAC	Cannery Creek Hatchery	Cannery Cr
AK01-36	TM	2001	2002		PINK	Alaska	Southeast	Port Armstrong	Port Armstrong	Port Armstrong
AK01-37	TM	2001	2002		PINK	Alaska	Southeast	Port Armstrong	Port Armstrong	Port Armstrong
AK01-38	TM	2001	2002		PINK	Alaska	Southeast	Port Armstrong	Port Armstrong	Port Armstrong
AK01-39	TM	2001	2002		PINK	Alaska	Southcentral	PWSAC	Armin F. Koernig Hatchery	Armin F. Koernig
AK01-40	TM	2001	2002		PINK	Alaska	Southeast	DIPAC	Gastineau Hatchery	Gastineau
AK01-41	TM	2001	2002		PINK	Alaska	Southcentral	PWSAC	Armin F. Koernig Hatchery	Armin F. Koernig
AK01-42	TM	2001	2002		PINK	Alaska	Southcentral	PWSAC	Armin F. Koernig Hatchery	Armin F. Koernig
AK01-43	TM	2001	2001		PINK	Alaska	Southcentral	VFDA	Solomon Gulch Hatchery	Solomon Gulch
AK01-44	TM	2001	2002		PINK	Alaska	Southcentral	PWSAC	Wally H.Noerenberg Hatchery	Wally H.Noerenberg
AK01-45	TM	2001	2002		PINK	Alaska	Southcentral	PWSAC	Wally H.Noerenberg Hatchery	Wally H.Noerenberg
AK01-46	TM	2001	2002		PINK	Alaska	Southcentral	PWSAC	Wally H.Noerenberg Hatchery	Wally H.Noerenberg

ID#	MARK NAME	STAGE	WEIGHT	LENGTH	ESIMATED RELEASE	RBr CODE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	COMMENTS
AK01-34	PORTGRAHAM01PINK					1:1.2,2.2	2,2H			
AK01-35	CANNERYCR01PINK					1:1.3,2.3	3,3H			
AK01-36	PORTARMSTRONG01EPINK	Early	31,666,000			1:1.3	3H			
AK01-37	PORTARMSTRONG01MPINK	Mid	30,675,375			1:1.3+2.3	3H3			
AK01-38	PORTARMSTRONG01LPINK	Late	10,322,405			1:1.3+2.4	3H4			
AK01-39	AFK01PINK					1:1.4	4H			
AK01-40	GASTINEAU01PINK		1,500,000			1:1.4	4H			
AK01-41	AFK01+3PINK					1:1.4+2.3	4H3			
AK01-42	AFK01+3PINK					1:1.4+2.5	4H5			
AK01-43	SOLOMONGULCH01PINK		202,573,328			1:1.6	6H			
AK01-44	WHN01PINK					1:1.8	8H			
AK01-45	WHN01+3PINK					1:1.8+2.3	8H3			
AK01-46	WHN01+5PINK					1:1.8+2.5	8H5			

Table 2. Summary of thermal mark codes applied to hatchery salmon in Washington and other states in brood year 2001.

SPECIES: CHINOOK

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W01-01	TM	2001			CHINOOK	Washington	NW	WDFW	Dungeness	Dungeness River spring
W01-02	TM	2001			CHINOOK	Washington	NW	WDFW	Dungeness	Dungeness River spring
W01-03	TM	2001			CHINOOK	Washington	NW	WDFW	LLTK Lilliwaup Hatchery	George Adams fall
W01-04	TM	2001			CHINOOK	Washington	NW	WDFW	LLTK Lilliwaup Hatchery	George Adams fall
W01-05	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-06	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-07	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-08	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-09	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-10	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-11	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-12	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-13	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-14	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-15	TM	2001			CHINOOK	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W01-16	TM	2001			CHINOOK	Washington	NW	Tulalip Tribes	Bernie Kai Kai Gobin Hatchery	Sammish River fall
W01-17	TM	2001			CHINOOK	Washington	NW	Tulalip Tribes	Bernie Kai Kai Gobin Hatchery	Snohomish River fall
W01-18	TM	2001			CHINOOK	Washington	NW	Tulalip Tribes	Bernie Kai Kai Gobin Hatchery	Snohomish River summer
W01-80	TM	2001			CHINOOK	Washington	SW	USFWS	Spring Creek Hatchery	Columbia River
O01-02	TM	2001	2002		CHINOOK	Oregon	NW	ODFW	Willamette Hatchery	Willamette River
O01-03	TM	2001	2002		CHINOOK	Oregon	NW	ODFW	Willamette Hatchery	South Santiam River
O01-04	TM	2001	2002		CHINOOK	Oregon	NW	ODFW	Willamette Hatchery	Clackamas River
O01-05	TM	2001	2002		CHINOOK	Oregon	NW	ODFW	Marion Forks Hatchery	North Santiam River

ID#	Release Site	STAGE	Total Released	Hatch Code	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift Direction	COMMENTS
W01-01	tributary		400,000	3,2,3H		0	heat	
W01-02	acclimation pond		400,000	2,3,2H		0	heat	
W01-03	Hamma Hamma River		55,000	2,3H		0	chill	
W01-04	Hamma Hamma River		55,000	4,1H		0	chill	
W01-05	on-station April release	fed fry	200,000	3,1H3,2			chill	
W01-06	Deadhorse Creek acclimation pond	fed fry	200,000	3,1H2,2			chill	
W01-07	Excelsior Creek side channel	fed fry	200,000	3,1H1,2n,4			chill	
W01-08	Deadhorse Creek acclimation pond	fed fry	200,000	3,3H3,3			chill	
W01-09	Kidney Creek	fed fry	200,000	3,1H4,1,1			chill	
W01-10	Excelsior Creek tributary	fed fry	200,000	3,1H2,2,2			chill	
W01-11	on-station June release	fed fry	200,000	3,1H2,1,1,2			chill	
W01-12	on-station June release	fed fry	200,000	3,1H1,4,1			chill	
W01-13	remote site incubator 1	unfed fry	100,000	5H		0	chill	
W01-14	Baptist Creek rsi 1	unfed fry	100,000	2,2H1,3			chill	
W01-15	Baptist Creek rsi 2	unfed fry	100,000	2,1,1H1,2			chill	
W01-16	Snohomish River		1,100,000	1,4,2H		0	chill	
W01-17	Snohomish River		500,000	1,2,1H		0	chill	
W01-18	Snohomish River		200,000	6H		0	chill	
W01-80	Columbia River		?	5H5			chill	
O01-02	Willamette River	fed fry	1,500,000	H8	0		chill	
O01-03	Willamette River	fed fry	1,500,000	H8	0		chill	
O01-04	Willamette River	fed fry	1,500,000	H8	0		chill	
O01-05	Willamette River	fed fry	1,500,000	H8	0		chill	

Table 2 (continued). Summary of thermal mark codes applied to hatchery salmon in Washington and other states in brood year 2001.

SPECIES: CHUM

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W01-19	TM	2001			CHUM	Washington	NW	WDFW	Hurd Creek Hatchery	Chimacum Creek summer
W01-20	TM	2001			CHUM	Washington	NW	WDFW	Hurd Creek Hatchery	Chimacum Creek summer
W01-21	TM	2001			CHUM	Washington	NW	WDFW	Washougal Hatchery	Duncan Creek summer
W01-22	TM	2001			CHUM	Washington	SW	WDFW	Grays River Hatchery	Grays River summer
W01-23	TM	2001			CHUM	Washington	SW	WDFW	Grays River Hatchery	Grays River summer
W01-24	TM	2001			CHUM	Washington	NW	WDFW	LLTK Lilliwaup Hatchery	Hamma Hamma River summer
W01-25	TM	2001			CHUM	Washington	NW	WDFW	LLTK Lilliwaup Hatchery	Hamma Hamma River summer
W01-26	TM	2001			CHUM	Washington	NW	WDFW	Hurd Creek Hatchery	Jimmycomelately Creek summer
W01-27	TM	2001			CHUM	Washington	NW	WDFW	Hurd Creek Hatchery	Jimmycomelately Creek summer
W01-28	TM	2001			CHUM	Washington	NW	WDFW	LLTK Lilliwaup Hatchery	Lilliwaup River summer
W01-29	TM	2001			CHUM	Washington	NW	WDFW	Hurd Creek Hatchery	Salmon Creek summer
W01-30	TM	2001			CHUM	Washington	NW	WDFW	Hurd Creek Hatchery	Salmon Creek summer
W01-31	TM	2001			CHUM	Washington	W central	WDFW	Bingham Creek Hatchery	Satsop Springs fall
W01-32	TM	2001			CHUM	Washington	W central	WDFW	George Adams Hatchery	Union River summer
W01-33	TM	2001			CHUM	Washington	W central	WDFW	George Adams Hatchery	Union River summer
W01-34	TM	2001			CHUM	Washington	NW	WDFW	Big Beef Creek Facility	Big Beef Creek summer
W01-35	TM	2001			CHUM	Washington	NW	WDFW	Big Beef Creek Facility	Big Beef Creek summer
W01-36	TM	2001			CHUM	Washington	NW	WDFW	Big Beef Creek Facility	Big Beef Creek summer

ID#	Release Site	STAGE	Total Released	Hatch Code	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift Direction	COMMENTS
W01-19	Chimacum Creek fresh water		31,500	3,2H		0	chill	
W01-20	Chimacum Creek netpen/estuary		58,500	4,1		0	chill	
W01-21	Duncan Creek		55,000	3,1H2,2,2			chill	
W01-22	Grays River	fed fry	350,000	3,1H4,1,1			chill	
W01-23	Chinook River	fed fry	100,000	3,1H1,1,4			chill	
W01-24	Hamma Hamma River		35,000	1,3,1H2,1,2			chill	
W01-25	Hamma Hamma River		35,000	1,3,1H		0	chill	
W01-26	JCL Creek - Wood site		30,000	2,1,1H		0	chill	
W01-27	JCL Creek - Valhalla site		40,000	1,1,2H		0	chill	
W01-28	Lilliwaup River		50,000	1,3,1H1,2,2			chill	
W01-29	Salmon Creek fry release		20,000	2,3H		0	chill	
W01-30	Salmon Creek rsi	unfed fry	80,000	6H		0	chill	
W01-31	Satsop Springs	unfed fry	250,000	2,2H		0	chill	
W01-32	Union River eyed eqq release	eyed eqq	45,000	3,1H		0	chill	
W01-33	Union River fry release		45,000	3,1H3,1			chill	
W01-34	Big Beef Creek 1	fed fry	30,000	3,1H2,1,1,1			chill	
W01-35	Big Beef Creek 2	fed fry	30,000	3,1H1,1,1,2			chill	
W01-36	Big Beef Creek 3	fed fry	30,000	3,1H1,1,3			chill	

Table 2 (continued). Summary of thermal mark codes applied to hatchery salmon in Washington and other states in brood year 2001.

SPECIES: SOCKEYE

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W01-50	TM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-51	TM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-52	TM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-53	TM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-54	TM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-55	TM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-56	TM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-57	TM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-58	IM	2001			SOCKEYE	Washington	W coast	Makah Tribes	Educket Tribal Hatchery	Lake Ozette
W01-59	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-60	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-61	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-62	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-63	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-64	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-65	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-66	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-67	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-68	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-69	IM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-70	IM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-71	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-72	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-73	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-74	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-75	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-76	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-77	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-78	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River
W01-79	TM	2001			SOCKEYE	Washington	NW	WDFW	Landsburg Hatchery	Cedar River

ID#	Release Site	STAGE	Total Released	Hatch Code	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift	Direction	COMMENTS
W01-50	Umbrella Creek, group 1	fingerling	70,000	3,3H		0		heat	
W01-51		fingerling		3,2H		0		heat	
W01-52	Stony Creek, group 2	fingerling	83,000	1,2,2H		0		heat	
W01-53		fingerling		1,1,2H		0		heat	
W01-54	Stony Creek, group 3	unfed fry	83,000	1,5H		0		heat	
W01-55		unfed fry		1,2,3H		0		heat	
W01-56		unfed fry		1,1,2,1H		0		heat	
W01-57	Umbrella Creek, group 4a	fingerling	37,500	5,1H		0		heat	
W01-58	Umbrella Creek, group 4b (IHN)	unfed fry	2,500	H5,1	0			heat	
W01-59	Cedar River, airport site	fed fry	500,000	1,2,2H		0		chill	
W01-60	Cedar River, airport site	fed fry	700,000	3,2,1H		0		chill	
W01-61	Cedar River, airport site	red try	560,000	2,2H		0		chill	
W01-62	Cedar River, airport site	red try	650,000	1,3,2H		0		chill	
W01-63	Cedar River, airport site	fed fry	525,000	2,3,1H		0		chill	
W01-64	Cedar River, airport site	fed fry	520,000	2,2,2H		0		chill	
W01-65	Cedar River, airport site	fed fry	570,000	2,1,2H		0		chill	
W01-66	Cedar River, airport site	fed fry	570,000	1,1,2,2,2,2H		0		chill	
W01-67	Cedar River, Riviera site	fed fry	315,000	1,2,1,2H		0		chill	
W01-68	Cedar River, Landsburg site	unfed fry	315,000	1,2,3,1H		0		chill	
W01-69	Cedar River, trestle site	unfed fry	320,000	1,1,5H		0		chill	
W01-70	Cedar River, Landsburg site	unfed fry	1,200,000	1,5H		0		chill	
W01-71	Cedar River, trestle site	unfed fry	200,000	1,4,1H		0		chill	
W01-72	Cedar River, Riviera site	unfed fry	275,000	1,1,3H		0		chill	
W01-73	Cedar River, trestle site	unfed fry	275,000	1,1,5H		0		chill	
W01-74	Cedar River, Riviera site	unfed fry	325,000	4,2,2H		0		chill	
W01-75	Cedar River, Riviera site	unfed fry	325,000	3,4H		0		chill	
W01-76	Cedar River, Landsburg site	unfed fry	330,000	5H		0		chill	
W01-77	Cedar River, Riviera site	unfed fry	550,000	1,2,1,3H		0		chill	
W01-78	Cedar River, Riviera site	unfed fry	560,000	1,2,1,2H		0		chill	
W01-79	Cedar River, trestle site	unfed fry	450,000	1,2,1,1H		0		chill	

Table 2 (continued). Summary of thermal mark codes applied to hatchery salmon in Washington and other states in brood year 2001.

SPECIES: COHO, CUTTHROAT, KOKANEE, PINK

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W01-37	TM	2001			COHO	Washington	NW	WDFW	Hurd Creek Hatchery	Crocker Lake
W01-38	TM	2001			COHO	Washington	NW	WDFW	Hurd Creek Hatchery	Crocker Lake
W01-39	TM	2001			COHO	Washington	NW	WDFW	Hurd Creek Hatchery	Crocker Lake
W01-40	TM	2001			COHO	Washington	NW	WDFW	Hurd Creek Hatchery	Dungeness River
W01-41	TM	2001			COHO	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River
W01-48	TM	2001			COHO	Washington	NW	WDFW	Washougal Hatchery	Lewis River
W01-42	TM	2001			CUTTHROAT	Washington	NE	WDFW	Collville Hatchery	Graham Lake
W01-43	TM	2001			CUTTHROAT	Washington	NE	WDFW	Collville Hatchery	Graham Lake
W01-44	TM	2001			CUTTHROAT	Washington	NE	WDFW	Collville Hatchery	Graham Lake
W01-45	TM	2001			KOKANEE	Idaho	N	IDFG	Cabinet Gorge Hatchery	Lake Pend Oreille
W01-46	TM	2001			KOKANEE	Washington	NW	WDFW	Chambers Creek Hatchery	Lake Whatcom
W01-47	TM	2001			KOKANEE	Washington	NW	WDFW	Bellingham Hatchery	Lake Whatcom
W01-49	TM	2001			PINK	Washington	NW	WDFW	Hurd Creek Hatchery	Dungeness River

ID#	Release Site	STAGE	Total Released	Hatch Code	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift Direction	COMMENTS
W01-37	Snow Creek		28,000	5H		0	chill	
W01-38	Andrews Creek		28,000	1,2,1H		0	chill	
W01-39	Crocker Lake		18,000	1,3,1H		0	chill	
W01-40	Dungeness River		25,000	2,2H		0	chill	
W01-41	Nooksack River		40,000	4,1H		0	chill	
W01-48	Lewis River		20,500	2,3H		0	chill	
W01-42	Graham Lake rsi release	unfed fry	9,000	5H		0	chill	
W01-43	Graham Lake fry release	fed fry	1,000	5H6			chill	
W01-44	Graham Lake yearling release	yearling	100	5H1,2,1			chill	
W01-45	Lake Pend Oreille	fed fry	7,000,000	H2,1,1	0		chill	
W01-46	Alder Lake		500,000	4H		0	dry/ice	
W01-47	Shannon Lake		300,000	5H		0	dry/ice	
W01-49	Dungeness River		100,000	5H		0	chill	