

**Thermal Mark Patterns Applied to Salmon from Alaska,  
Washington, Treaty Tribes and Other Northwest States  
for Brood Year 2004**

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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 2004 brood year. It includes release numbers where known and mark patterns applied in Alaska, Washington, Oregon, Idaho 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 is also being used to determine the origin of juvenile and immature salmon collected during biotic surveys in the Gulf of Alaska and the Bering Sea. 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 need to identify specific stocks, and the existence of a program to recover and identify the thermal patterns. It has become increasingly difficult to create and apply unique patterns as the hatchery marking programs have expanded. 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 2004 is provided in Table 1. Although final release estimates have not been reported by all the hatchery operations as of this date, there are a total of 71 different mark groups. To date, more than 1.2 billion marked fish have been released.

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 and from the NPAFC Working Group on Salmon Marking's Website (<http://npafc.taglab.org>).

### **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 BY2004 salmon in Washington State (WDF&W and State treaty tribes), Oregon and other western states is presented in Table 2. More than 68 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. If 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 BY2004 mark patterns are represented as a schematic of thermal events. For consistency, these patterns are also 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.
- Munk, K.M. and Geiger, H.J. 1998. Thermal marking of otoliths: the “RBr” coding structure of thermal marks. (NPAFC Doc. 367). 19 p. Alaska Dept. of Fish and Game, Juneau Alaska.
- Volk, E.C., S.L. Schroder, J.J. Grimm and H.S. Ackley. 1994. Use of a bar code symbology to produce multiple thermally induced marks. *Trans. Am. Fish. Soc.* 123:811-816.
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Table 1. Summary of thermal mark codes applied to Alaska hatchery salmon in brood year 2004.

SPECIES: CHINOOK

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK04-01	TM	2004	2006		Chinook	Alaska	Southcentral	ADFG	Fort Richardson Hatchery	Cook Inlet
AK04-02	TM	2004	2006		Chinook	Alaska	Southcentral	ADFG	Fort Richardson Hatchery	Ship Creek
AK04-03	TM	2004	2006		Chinook	Alaska	Southcentral	ADFG	Fort Richardson Hatchery	Ressurrection Bay
AK04-08	TM	2004	2005		Chinook	Alaska	Southcentral	ADFG	Fort Richardson Hatchery	Ressurrection Bay
AK04-04	TM	2004	2006		Chinook	Alaska	Southeast	NSRAA	Medvejie Hatchery	Medvejie
AK04-05	TM	2004	2006		Chinook	Alaska	Southeast	NSRAA	Hidden Falls Hatchery	Hidden Falls
AK04-06	TM	2004	2006		Chinook	Alaska	Southeast	NSRAA	Medvejie Hatchery	Medvejie

ID#	MARK NAME	STAGE	WEIGHT	LENGTH	ESIMATED RELEASE	RBr CODE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	COMMENTS
AK04-01	COOKINLET04CHIN				1,090,000	1:1.2,2.3	2,3H			Repeats each year
AK04-02	PWS04CHIN				315,000	1:1.2,2.4	2,4H			Repeats each year
AK04-03	RESURRECTION04CHIN				105,000	1:1.2,2.5	2,5H			Repeats each year
AK04-08	SEALIFE04CHIN				105,000	1:1.2,2.6	2,6H			Repeats each year
AK04-04	GREENLAKE04CHIN				1,000,000	1:1.3,2.3	3,3H			Repeats each year
AK04-05	HIDDENFALLS04CHIN				1,500,000	1:1.4,2.2	4,2H			Repeats each year
AK04-06	MEDVEJIE04				1,300,000	1:1.4,2.3	4,3H			Repeats each year

SPECIES: COHO

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK04-35	TM	2004	2005		Coho	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	Bear Lake
AK04-36	TM	2004	2005		Coho	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	Bear Lake
AK04-37	TM	2004	2006		Coho	Alaska	Southcentral	PWSAC	Wally H. Noerenberg Hatchery	Wally H. Noerenberg
AK04-38	TM	2004	2006		Coho	Alaska	Southeast	NSRAA	Medvejie Hatchery	Medvejie
AK04-39	TM	2004	2006		Coho	Alaska	Southcentral	ADFG	Fort Richardson Hatchery	Bear Lake
AK04-40	TM	2004	2006		Coho	Alaska	Southeast	DIPAC	Macaulay Hatchery	Macaulay
AK04-41	TM	2004	2006		Coho	Alaska	Southeast	AKI	Port Armstrong Hatchery	Port Armstrong
AK04-42	TM	2004	2006		Coho	Alaska	Southcentral	ADFG	Fort Richardson Hatchery	Ship & Jim Creek
AK04-76	TM	2004	2006		Coho	Alaska	Southcentral	VFDA	Solomon Gulch Hatchery	Solomon Gulch

ID#	MARK NAME	STAGE	WEIGHT	LENGTH	ESIMATED RELEASE	RBr CODE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	COMMENTS
AK04-35	TRAILLAKES04SMCOHO				450,000	1:1.3,2.3	3,3H			Repeats each year
AK04-36	TRAILLAKES04LGCOHO				150,000	1:1.3,2.3+3.2	3,3H2			Repeats each year
AK04-37	WHN04COHO				300,000	1:1.3	3H			Repeats each year
AK04-38	MEDVEJIE04COHO				2,500,000	1:1.4,2.2	4,2H			Repeats each year
AK04-39	RESURRECTION04COHO				240,000	1:1.4	4H			Repeats each year
AK04-40	DIPAC04COHO				800,000	1:1.4	4H			Alternates each year
AK04-41	PORTARMSTRONG04COHO				1,600,000	1:1.5	5H			
AK04-42	COOKINLET04COHO				640,000	1:1.5	5H			Repeats each year
AK04-76	SGH04COHO					1:1.6	6H			Repeats each year

Table 1 (continued). Summary of thermal mark codes applied to Alaska hatchery salmon in brood year 2004.

SPECIES: CHUM

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK04-09	TM	2004	2005	5/6/2005	Chum	Alaska	Southeast	SSRAA	Neets Bay Hatchery	Neets Bay
AK04-10	TM	2004	2005	5/9/2005	Chum	Alaska	Southeast	SSRAA	Neets Bay Hatchery	Neets Bay
AK04-11	TM	2004	2005	4/28/2005	Chum	Alaska	Southeast	SSRAA	Neets Bay Hatchery	Neets Bay
AK04-20	TM	2004	2005	5/20/2005	Chum	Alaska	Southeast	NSRAA	Hidden Falls Hatchery	Hidden Falls
AK04-13	TM	2004	2005	5/15/2005	Chum	Alaska	Southeast	NSRAA	Herman Creek	Chilkat
AK04-14	TM	2004	2005	4/25/2005	Chum	Alaska	Southeast	SSRAA	Neets Bay Hatchery	Neets Bay
AK04-15	TM	2004	2005	4/28/2005	Chum	Alaska	Southeast	NSRAA	Hidden Falls Hatchery	Hidden Falls
AK04-16	TM	2004	2005	5/21/2005	Chum	Alaska	Southeast	NSRAA	Hidden Falls Hatchery	Hidden Falls
AK04-17	TM	2004	2005	6/3/2005	Chum	Alaska	Southeast	NSRAA	Hidden Falls Hatchery	Hidden Falls
AK04-18	TM	2004	2005	5/1/2005	Chum	Alaska	Southcentral	PWSAC	Wally H. Noerenberg Hatchery	Wally H. Noerenberg
AK04-19	TM	2004	2005		Chum	Alaska	Western			Nome
AK04-21	TM	2004	2005	4/23/2005	Chum	Alaska	Southeast	SSRAA	Neets Bay Hatchery	Neets Bay
AK04-12	TM	2004	2005	5/24/2005	Chum	Alaska	Southeast	NSRAA	Hidden Falls Hatchery	Hidden Falls
AK04-22	TM	2004	2005	5/1/2005	Chum	Alaska	Southcentral	PWSAC	Wally H. Noerenberg Hatchery	Wally H. Noerenberg
AK04-23	TM	2004	2005	6/3/2005	Chum	Alaska	Southeast	DIPAC	Macaulay Hatchery	Macaulay
AK04-24	TM	2004	2005	5/12/2005	Chum	Alaska	Southeast	DIPAC	Macaulay Hatchery	Macaulay
AK04-25	TM	2004	2005	6/3/2005	Chum	Alaska	Southeast	DIPAC	Macaulay Hatchery	Macaulay
AK04-26	TM	2004	2005	5/30/2005	Chum	Alaska	Southeast	DIPAC	Macaulay Hatchery	Macaulay
AK04-27	TM	2004	2005	5/22/2005	Chum	Alaska	Southeast	DIPAC	Macaulay Hatchery	Macaulay
AK04-28	TM	2004	2005	6/3/2005	Chum	Alaska	Southeast	DIPAC	Macaulay Hatchery	Macaulay
AK04-29	TM	2004	2005	5/11/2005	Chum	Alaska	Southeast	SSRAA	Neets Bay Hatchery	Neets Bay
AK04-30	TM	2004	2005	5/12/2005	Chum	Alaska	Southeast	NSRAA	Medvejie Hatchery	Medvejie
AK04-31	TM	2004	2005	5/1/2005	Chum	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
AK04-09	ANITABAY04	Fingerling	2.95	63	13,551,600	1:1.3,2.2n,3.2n	3,2n,2nH			
AK04-10	NAKATINLET04FALL	Fall	2.24	60	9,764,000	1:1.1,2.4n,3.2	1,4n,2H			
AK04-11	NEETS BAY04SUM	Summer	2.55	66	48,633,000	1:1.1,2.5n,3.2n	1,5n,2nH			
AK04-20	TAKATZ04	Fed Fry	2.03		44,984,748	1:1.3,2.2,3.2	3,2,2H			
AK04-13	CHILKAT04				813,781	1:1.3,2.2	3,2H			
AK04-14	NAKATINLET04SUM	Summer	2.75	66	7,916,500	1:1.1,2.3n,3.2n	1,3n,2nH			
AK04-15	DEEPINLETHF04		2.03		17,727,000	1:1.3,2.3	3,3H			
AK04-16	DEEPINLETHF04LL/LG	Late Large	3.94		5,824,000	1:1.3,2.4	3,4H			
AK04-17	HIDDENFALLS04LL/LG	Late Large	3.3		9,917,604	1:1.3,2.5	3,5H			
AK04-18	PORTCHALMERS04				25,000,000	1:1.3	3H			
AK04-19	NOME04	Eyed Egg			20,000	1:1.3	3H			<i>Experimental</i>
AK04-21	KENDRICKBAY04	Fingerling	2.95	70	19,699,000	1:1.3,2.1,3.2	3,1,2H			
AK04-12	HIDDENFALLS04		1.99		33,897,948	1:1.4,2.2	4,2H			<i>Repeats each year</i>
AK04-22	WHN04A				30,000,000	1:1.4,2.3	4,3H			
AK04-23	AMALGA04A		2.35	66	31,672,288	1:1.4	4H			<i>three year rotation</i>
AK04-24	GASTINEAU04A		2.47	68	17,672,298	1:1.4+2.3	4H3			<i>three year rotation</i>
AK04-25	GASTINEAU04B		4.42	82	17,596,649	1:1.4+2.3,3.3	4H3,3			<i>three year rotation</i>
AK04-26	BOATHARBOR04		3.63		13,558,987	1:1.4+2.4	4H4			<i>three year rotation</i>
AK04-27	LIMESTONE04		3.17		15,005,171	1:1.4+2.5	4H5			<i>three year rotation</i>
AK04-28	AMALGA04B		5.44	87	5,118,857	1:1.4+2.6	4H6			<i>three year rotation</i>
AK04-29	NEETS BAY04FALL	Fall	1.85	58	21,432,000	1:1.4n,2.2,3.2n	4n,2,2nH			
AK04-30	DEEPINLETMJ04LL	Late Large	3.98		5,010,000	1:1.5	5H			
AK04-31	WHN04B				20,000,000	1:1.6	6H			

Table 1 (continued). Summary of thermal mark codes applied to Alaska hatchery salmon in brood year 2004.

SPECIES: SOCKEYE

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK04-54	TM	2004	2005		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	Hidden Lake
AK04-55	TM	2004	2005		Sockeye	Alaska	Southeast	POWHA	Klawock River Hatchery	Klawock Lake
AK04-56	TM	2004	2005		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	Bear Lake
AK04-66	TM	2004	2006		Sockeye	Alaska	Southeast	SSRAA	Burnett Inlet Hatchery	McDonald Lake
AK04-58	TM	2004	2006		Sockeye	Alaska	Southcentral	PWSAC	Main Bay Hatchery	Main Bay
AK04-59	TM	2004	2006		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	Bear Lake
AK04-61	TM	2004	2006		Sockeye	Alaska	Southeast	DIPAC	Snettisham Hatchery	Snettisham
AK04-60	TM	2004	2005		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	Hidden Lake
AK04-62	TM	2004	2005	5/20/2005	Sockeye	Alaska	Southeast	DIPAC	Snettisham Hatchery	Tatsamenie Lake
AK04-64	TM	2004	2005	5/20/2005	Sockeye	Alaska	Southeast	DIPAC	Snettisham Hatchery	Tatsamenie Lake
AK04-57	TM	2004	2006		Sockeye	Alaska	Southeast	SSRAA	Burnett Inlet Hatchery	McDonald Lake
AK04-65	TM	2004	2005	5/17/2005	Sockeye	Alaska	Southeast	DIPAC	Snettisham Hatchery	Snettisham
AK04-63	TM	2004	2005	6/16/2005	Sockeye	Alaska	Southeast	DIPAC	Snettisham Hatchery	Tahltan Lake
AK04-67	TM	2004	2005	5/17/2005	Sockeye	Alaska	Southeast	DIPAC	Snettisham Hatchery	Tahltan Lake
AK04-73	TM	2004	2005		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	English Bay Lake
AK04-74	TM	2004	2005		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	English Bay Lake
AK04-75	TM	2004	2005		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	English Bay Lake
AK04-68	TM	2004	2005		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	Bear Lake
AK04-69	TM	2004	2005		Sockeye	Alaska	Southcentral	CIAA	Trail Lakes Hatchery	Big Lake

ID#	MARK NAME	STAGE	WEIGHT	LENGTH	ESIMATED RELEASE	RBr CODE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	COMMENTS
AK04-54	TRAILLAKES04				6,000,000	1:1.2,2.2	2,2H			
AK04-55	KLAWOCK04				365,000	1:1.2,2.3	2,3H			
AK04-56	BEARLAKE04A				700,000	1:1.2,2.4	2,4H			
AK04-66	NECKLAKE04				750,000	1:1.2,2.5n	2,5nH			
AK04-58	MAINBAY04				8,000,000	1:1.3,2.2	3,2H			
AK04-59	BEARLAKE04C				250,000	1:1.3,2.3+3.3	3,3H3			
AK04-61	SPEELARM04	ES			1,500,000	1:1.3,2.3n	3,3nH			
AK04-60	HIDDENLAKE04				600,000	1:1.4,2.2	4,2H			
AK04-62	TATSAMENIE04A		0.2		261,279	1:1.4+2.3,3.3	4H3,3			
AK04-64	TATSAMENIE04B		0.17		366,778	1:1.4+2.5n	4H5n			
AK04-57	BURNETTINLET04	Smolts			250,000	1:1.4n,2.2	4n,2H			
AK04-65	SWEETHEART04		0.15		546,845	1:1.5,2.3n	5,3nH			
AK04-63	TUYA04		0.14		3,200,094	1:1.6+2.4	6H4			
AK04-67	TAHLTAN04		0.13		1,226,478	1:1.6+2.6	6H6			
AK04-73	ENGLISHBAYLAKE04				200,000	2:1.3,2.2	H3,2			
AK04-74	TUTKASOCKEYE04				650,000	2:1.3,2.3	H3,3			
AK04-75	PORTGRAHAM04SOCKEYE				650,000	2:1.3,2.4	H3,4			
AK04-68	BEARLAKE04B				1,000,000	2:1.4	H4			
AK04-69	BIGLAKE04				1,500,000	2:1.5	H5			

Table 1 (continued). Summary of thermal mark codes applied to Alaska hatchery salmon in brood year 2004.

SPECIES: PINK

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
AK04-43	TM	2004	2005	5/22/2005	Pink	Alaska	Southcentral	PWSAC	Cannery Creek Hatchery	Cannery Creek
AK04-44	TM	2004	2005	5/28/2005	Pink	Alaska	Southeast	AKI	Port Armstrong Hatchery	Port Armstrong
AK04-71	TM	2004	2005		Pink	Alaska	Western			Nome
AK04-45	TM	2004	2005	5/12/2005	Pink	Alaska	Southeast	AKI	Port Armstrong Hatchery	Port Armstrong
AK04-46	TM	2004	2005	5/31/2005	Pink	Alaska	Southeast	AKI	Port Armstrong Hatchery	Port Armstrong
AK04-47	TM	2004	2005		Pink	Alaska	Southcentral	PWSAC	Armin F. Koernig Hatchery	Armin F. Koernig
AK04-48	TM	2004	2005		Pink	Alaska	Southcentral	PWSAC	Armin F. Koernig Hatchery	Armin F. Koernig
AK04-49	TM	2004	2005		Pink	Alaska	Southcentral	PWSAC	Armin F. Koernig Hatchery	Armin F. Koernig
AK04-72	TM	2004	2005		Pink	Alaska	Southeast	NMFS	Auke Creek Hatchery	Auke Creek
AK04-50	TM	2004	2005	5/9/2005	Pink	Alaska	Southcentral	VFDA	Solomon Gulch Hatchery	Solomon Gulch
AK04-51	TM	2004	2005		Pink	Alaska	Southcentral	PWSAC	Wally H. Noerenberg Hatchery	Wally H. Noerenberg
AK04-52	TM	2004	2005		Pink	Alaska	Southcentral	PWSAC	Wally H. Noerenberg Hatchery	Wally H. Noerenberg
AK04-53	TM	2004	2005		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
AK04-43	CCH04		0.42		126,575,805	1:1.3,2.3	3,3H			Repeats each year
AK04-44	PORTARMSTRONG04E	E	0.66		32,690,720	1:1.3	3H			Repeats each year
AK04-71	HOBSON04				20,000	1:1.3	3H			Experimental
AK04-45	PORTARMSTRONG04M	M	0.75		34,683,180	1:1.3+2.3	3H3			Repeats each year
AK04-46	PORTARMSTRONG04L	L	1.17		12,737,052	1:1.3+2.4	3H4			Repeats each year
AK04-47	AFK04E				50,000,000	1:1.4	4H			Repeats each year
AK04-48	AFK04L1				50,000,000	1:1.4+2.3	4H3			Repeats each year
AK04-49	AFK04L2				50,000,000	1:1.4+2.5	4H5			Repeats each year
AK04-72	WHN0L2PINK				40,000,000	1:1.5	5H			Repeats each year
AK04-50	SGH04		0.81	50	222,218,569	1:1.6	6H			Repeats each year
AK04-51	WHN04EPINK				40,000,000	1:1.8	8H			Repeats each year
AK04-52	WHN04L1PINK				40,000,000	1:1.8+2.3	8H3			Repeats each year
AK04-53	WHN0L2PINK				40,000,000	1:1.8+2.5	8H5			Repeats each year



Table 2. Summary of thermal mark codes applied to hatchery salmon in Washington and other states in brood year 2004.

SPECIES: CHINOOK

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W04-02	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W04-03	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W04-04	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W04-05	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W04-06	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W04-07	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W04-08	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River spring
W04-09	TM	2004	2005		Chinook	Washington	NW	WDFW	George Adams Hatchery	Hamma Hamma River fall
W04-10	TM	2004	2005		Chinook	Washington	NW	WDFW	George Adams Hatchery	Purdy Creek fall
W04-11	TM	2004	2005		Chinook	Washington	NW	Tulalip Tribes	Bernie Kai Kai Gobin Hatchery	Snohomish River summers
W04-12	TM	2004	2005		Chinook	Washington	NW	Tulalip Tribes	Bernie Kai Kai Gobin Hatchery	Snohomish River summers
W04-13	TM	2004	2005		Chinook	Washington	NW	WDFW	George Adams Hatchery	Purdy Creek fall
W04-14	TM	2004	2005		Chinook	Washington	NW	WDFW	Hurd Creek Hatchery	Elwha River fall
W04-15	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Samish River fall
W04-16	TM	2004	2005		Chinook	Washington	NW	WDFW	Kendall Creek Hatchery	Samish River fall
W04-17	TM	2004	2005		Chinook	Washington	NW	WDFW	Sol Duc Hatchery	Elwha River fall
O04-01	TM	2004	2005		Chinook	Oregon	NW	ODFW	Marion Forks Hatchery	Willamette River springs
O04-02	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs
O04-03	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs
O04-04	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs
O04-05	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs
O04-06	TM	2004	2005		Chinook	Oregon	NW	ODFW	McKenzie Hatchery	Willamette River springs
O04-07	TM	2004	2005		Chinook	Oregon	NW	ODFW	McKenzie Hatchery	Willamette River springs
O04-08	TM	2004	2005		Chinook	Oregon	NW	ODFW	McKenzie Hatchery	Willamette River springs
O04-09	TM	2004	2005		Chinook	Oregon	NW	ODFW	McKenzie Hatchery	Willamette River springs
O04-10	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs
O04-11	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs
O04-12	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs
O04-13	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs
O04-14	TM	2004	2005		Chinook	Oregon	NW	ODFW	Willamette Hatchery	Willamette River springs

  

ID#	RELEASE SITE	STAGE	ESIMATED RELEASE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift Direction	COMMENTS
W04-02	Nooksack River	fed fry	48,500	2,2H1,2,1			chill	
W04-03	Bridge Camp 1 non acclimated	fed fry	144,000	2,2H4,2			heat	
W04-04	Bridge Camp 2 non acclimated	fed fry	144,000	2,2H2,1,2			heat	
W04-05	Nooksack River midfork	fed fry	208,000	2,2H1,1,2,1			heat	
W04-06	Bridge Camp 3	fed fry	124,000	2,2H2,2,2			heat	
W04-07	Nooksack River	fed fry	55,700	2,2H2,4			heat	
W04-08	Nooksack River	fed fry	50,700	2,2H1,1,1,1			chill	
W04-09	Hamma Hamma River	fed fry	15,000	2,1,1H1,1,4,2			chill	
W04-10	Hamma Hamma River	fed fry	22,500	2,1H		0	chill	
W04-11	Tulalip River	fed fry	1,000,000	1,4,1H		0	chill	
W04-12	Tulalip River	fed fry	1,000,000	H1,4,1	0		chill	
W04-13	Hamma Hamma River	fed fry	22,500	6H		0	chill	
W04-14	Elwha River	fed fry	250,000	2,2H1,2,1			chill	
W04-15	Samish River	fed fry	4,000,000	1,2,1H		0	chill	
W04-16	Samish River	fed fry	600,000	5H1,4			chill	
W04-17	Elwha River	fed fry	3,100,000	1,1,1,1,1H		0	chill	
O04-01	North Santiam River	fed fry	912,000	H8, 2	0		chill	
O04-02	Willamette River	fed fry	700,000	H6	0		chill	
O04-03	South Santiam River	fed fry	400,000	H6,1	0		chill	
O04-04	Clackamas River	fed fry	500,000	H6	0		chill	
O04-05	Sandy River	fed fry	325,000	H1,3,3,1	0		chill	
O04-06	McKenzie River	fed fry	300,000	1,1,1,1H1,2,1,1,1			chill	
O04-07	McKenzie River	fed fry	300,000	1,1,1,1H1,1,1,1			chill	
O04-08	McKenzie River	fed fry	300,000	1,1,1,1H1,1,1,1			chill	
O04-09	McKenzie River	fed fry	300,000	1,1,1,1H1 - 1,1,1,1			chill	
O04-10	Willamette River	fed fry	700,000	H6,1	0		chill	
O04-11	Willamette River	fed fry	700,000	H1,2,4	0		chill	
O04-12	South Santiam River	fed fry	400,000	H7	0		chill	
O04-13	South Santiam River	fed fry	400,000	H7	0		chill	
O04-14	Clackamas River	fed fry	500,000	H1,6,1	0		chill	

Table 2 (continued). Summary of thermal mark codes applied to hatchery salmon in Washington and other states in brood year 2004.

SPECIES: CHUM

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W04-18	TM	2004	2005		Chum	Washington	NW	WDFW	Lilliwaup Hatchery	Hamma Hamma River summer
W04-19	TM	2004	2005		Chum	Washington	NW	WDFW	Lilliwaup Hatchery	Hamma Hamma River summer
W04-20	TM	2004	2005		Chum	Washington	NW	WDFW	Hurd Creek Hatchery	Jimmycomelately Creek summer
W04-21	TM	2004	2005		Chum	Washington	NW	WDFW	Hurd Creek Hatchery	Jimmycomelately Creek summer
W04-22	TM	2004	2005		Chum	Washington	NW	WDFW	Lilliwaup Hatchery	Lilliwaup River summer
W04-23	TM	2004	2005		Chum	Washington	NW	WDFW	Big Beef Creek Facility	Big Beef Creek summer
W04-24	TM	2004	2005		Chum	Washington	NW	WDFW	Big Beef Creek Facility	Big Beef Creek summer
W04-25	TM	2004	2005		Chum	Washington	NW	WDFW	Big Beef Creek Facility	Big Beef Creek summer
W04-26	TM	2004	2005		Chum	Washington	SW	WDFW	Grays River Hatchery	Grays River
W04-27	TM	2004	2005		Chum	Washington	SW	WDFW	Grays River Hatchery	Grays River and Chinook River
W04-28	TM	2004	2005		Chum	Washington	NW	WDFW	George Adams Hatchery	Union River summer
W04-29	TM	2004	2005		Chum	Washington	NW	WDFW	George Adams Hatchery	Union River summer
W04-30	TM	2004	2005		Chum	Washington	NW	WDFW	George Adams Hatchery	Union River summer
W04-31	Sr	2004	2005		Chum	Washington	SW	WDFW	Washougal Hatchery	Duncan Creek summers
W04-32	TM	2004	2005		Chum	Washington	NW	WDFW	Lilliwaup Hatchery	Hamma Hamma River summer
W04-33	TM	2004	2005		Chum	Washington	NW	WDFW	Lilliwaup Hatchery	Hamma Hamma River summer
W04-34	TM	2004	2005		Chum	Washington	NW	WDFW	Lilliwaup Hatchery	Lilliwaup River summer
W04-35	TM	2004	2005		Chum	Washington	NW	WDFW	Lilliwaup Hatchery	Lilliwaup River summer

ID#	RELEASE SITE	STAGE	ESIMATED RELEASE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift Direction	COMMENTS
W04-18	Hamma Hamma River	fed fry	38,000	2,1,2H2,1,2			chill	
W04-19	Hamma Hamma River	eyed egg	38,000	2,4H		0	chill	
W04-20	JCL Creek - Wood site	eyed egg	27,000	1,2,1,1H		0	chill	
W04-21	JCL Creek - Valhalla site	eyed egg	50,000	1,1,2,1		0	chill	
W04-22	Lilliwaup River	fed fry	117,000	2,4H3,1,2			chill	
W04-23	Big Beef Creek 1	fed fry	35,000	4,1,1H3,2			chill	
W04-24	Big Beef Creek 2	fed fry	35,000	4,1H1,2,2			chill	
W04-25	Big Beef Creek 3	fed fry	17,000	4,1,1H3,1,1			chill	
W04-26	Grays River	fed fry	400,000	4,1H1,1,4,2			chill	
W04-27	Chinook River	fed fry	100,000	4,1H2,3,1,1			chill	
W04-28	Tahuya River	unfed fry	40,000	2,1H		0	chill	
W04-29	Tahuya River	unfed fry	40,000	1,3H		0	chill	
W04-30	Tahuya River	fed fry	47,500	1,3H1,3			chill	
W04-31	Duncan Creek	unfed fry	27,500	na	na	na	chill	
W04-32	Hamma Hamma River	fed fry	38,000	2,1,2H2,2,2			chill	
W04-33	Hamma Hamma River	fed fry	38,000	2,4H2,1,2			chill	
W04-34	Lilliwaup River	fed fry	58,000	2,1,2H3,2			chill	
W04-35	Lilliwaup River	fed fry	58,000	2,1,2H3,1,2			chill	

Table 2 (continued). Summary of thermal mark codes applied to hatchery salmon in Washington and other states in brood year 2004.

SPECIES: SOCKEYE

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W04-49	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-50	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-51	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-52	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-53	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-54	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-55	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-56	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-57	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-58	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-59	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-60	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-61	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-62	TM	2004	2005		Sockeye	Washington	NW	Makah Tribes	Makah National Fish Hatchery	Lake Ozette
W04-63	TM	2004	2005		Sockeye	Washington	NW	Makah Tribes	Makah National Fish Hatchery	Lake Ozette
W04-64	TM	2004	2005		Sockeye	Washington	NW	Makah Tribes	Makah National Fish Hatchery	Lake Ozette
W04-65	TM + calcein	2004	2005		Sockeye	Washington	NW	Makah Tribes	Makah National Fish Hatchery	Lake Ozette
W04-66	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-67	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-68	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-69	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-70	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-71	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-72	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-73	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-74	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-75	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-76	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-77	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington
W04-78	TM	2004	2005		Sockeye	Washington	NW	WDFW	Landsburg Hatchery	Lake Washington

ID#	RELEASE SITE	STAGE	ESIMATED RELEASE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift Direction	COMMENTS
W04-49	Cedar River upriver	unfed fry	400,000	1,2,1H1,2,2				chill
W04-50	Cedar River upriver	unfed fry	400,000	1,2,1H1,2,2				chill
W04-51	Cedar River upriver	unfed fry	630,000	1,2,1H1,4,1				chill
W04-52	Cedar River upriver	unfed fry	630,000	1,2H1,4,1				chill
W04-53	Cedar River upriver	unfed fry	630,000	H1,3,1	0			chill
W04-54	Cedar River downriver	unfed fry	500,000	1,2,1H2,2,2				chill
W04-55	Cedar River downriver	unfed fry	500,000	1,2,1H2,2,1				chill
W04-56	Cedar River downriver	unfed fry	500,000	2,1H2,2,2				chill
W04-57	Cedar River downriver	unfed fry	500,000	1,2,1H1,1,4				chill
W04-58	Cedar River downriver	unfed fry	500,000	1,1,1H1,1,4				chill
W04-59	Cedar River downriver	unfed fry	500,000	1,2,1H1,1,4				chill
W04-60	Cedar River downriver	unfed fry	690,000	2,1H2,1,2				chill
W04-61	Cedar River downriver	unfed fry	690,000	1,2,1H2,1,2				chill
W04-62	Umbrella Creek, Gr 1	fingerling	46,000	3,3H		0		heat
W04-63	Big River, Gr 2	unfed fry	80,000	1,2,2H		0		heat
W04-64	Big River, Gr 3	fingerling	82,000	1,6H		0		heat
W04-65	Umbrella Creek, Gr 1b	unfed fry	90,000	3,4H		0		heat
W04-66	Cedar River downriver	unfed fry	690,000	4H3,2,1				chill
W04-67	Cedar River downriver	unfed fry	690,000	1,3H3,2,1				chill
W04-68	Cedar River downriver	unfed fry	690,000	1,2,1H1,2,1				chill
W04-69	Cedar River downriver	unfed fry	690,000	1,2,2H3,2,1				chill
W04-70	Cedar River downriver	unfed fry	490,000	1,2H1,1,1				chill
W04-71	Cedar River downriver	unfed fry	490,000	2,1H1,1,1				chill
W04-72	Cedar River downriver	unfed fry	490,000	2,1H1,1,2,2				chill
W04-73	Cedar River downriver	unfed fry	490,000	1,2,1H1,1,2,2				chill
W04-74	Cedar River downriver	unfed fry	490,000	1,2H1,1,2				chill
W04-75	Cedar River downriver	unfed fry	500,000	1,2H2,2,1				chill
W04-76	Cedar River downriver	unfed fry	490,000	1,2H		0		chill
W04-77	Cedar River downriver	unfed fry	490,000	1,2H2				chill
W04-78	Cedar River downriver	unfed fry	500,000	1,2H2,2,2				chill

Table 2 (continued). Summary of thermal mark codes applied to hatchery salmon in Washington and other states in brood year 2004.

SPECIES: COHO

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W04-36	TM	2004	2005		Coho	Washington	SW	WDFW	Washougal Hatchery	Lewis River
W04-37	TM	2004	2005		Coho	Washington	NW	Tulalip Tribes	Bernie Kai Kai Gobin Hatchery	Snohomish River
W04-38	TM	2004	2005		Coho	Washington	NW	WDFW	George Adams Hatchery	Sherwood Creek
W04-39	TM	2004	2005		Coho	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River
W04-40	TM	2004	2005		Coho	Washington	NW	WDFW	Kendall Creek Hatchery	Nooksack River

ID#	RELEASE SITE	STAGE	ESIMATED RELEASE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift Direction	COMMENTS
W04-36	Cedar Creek	unfed fry	450,000	2,2,1H		0	chill	
W04-37	Tulalip River	fed fry	1,500,000	1,2,1H4			chill	
W04-38	Sherwood Creek	fed fry	200,000	2,1,2H		0	chill	
W04-39	Toad Creek/Nooksack River	fed fry	15,000	2,1,1H		0	chill	
W04-40	Deer Creek/Nooksack River	fed fry	40,000	1,2,1H		0	chill	

SPECIES: ATLANTIC, KOKANEE, and STEELHEAD

ID#	MARK TYPE	BROOD YEAR	RELEASE YEAR	DATE LAST RELEASED	SPECIES	STATE/ PROVINCE	REGION RELEASE	AGENCY	FACILITY	STOCK
W04-01	TM	2004	2005		Atlantics	Washington	West central	WDFW	Cypress Island Fish Farm	broodstock
W04-41	TM	2004	2005		Kokanee	Washington	West central	WDFW	Lakewood Hatchery	Alder Lake
W04-42	TM	2004	2005		Kokanee	Washington	West central	WDFW	Lakewood Hatchery	Alder Lake
W04-43	TM	2004	2005		Kokanee	Washington	West central	WDFW	Lakewood Hatchery	Alder Lake
W04-44	TM	2004	2005		Kokanee	Washington	NE	WDFW	Spokane Hatchery	Banks Lake - Spokane Tribes
W04-45	TM	2004	2005		Kokanee	Washington	NE	WDFW	Spokane Hatchery	Banks Lake - WDFW
W04-46	TM	2004	2005		Kokanee	Washington	NE	Spokane Tribes	Spokane Tribal Hatchery	Lake Roosevelt
W04-47	TM	2004	2005		Kokanee	Washington	NE	WDFW	Spokane Tribal Hatchery	Lake Roosevelt
I04-01	TM	2004	2005		Kokanee	Idaho	NW	IDFG	Cabinet Gorge Hatchery	Lake Pend Oreille
I04-02	TM	2004	2005		Kokanee	Idaho	NW	IDFG	Cabinet Gorge Hatchery	Canadian
W04-48	TM	2004	2005		Rainbow	Washington	NE	WDFW	Spokane Hatchery	Banks Lake - Spokane Tribes

ID#	RELEASE SITE	STAGE	ESIMATED RELEASE	HATCH CODE	Pre-Hatch Graphic	Post-Hatch Graphic	Temp. Shift Direction	COMMENTS
W04-01	no release	no release	8,000,000	3H		0	chill	
W04-41	Alder Lake	unfed fry	273,000	1,1,1H		0	chill	
W04-42	American Lake	unfed fry	200,000	1,1,1H		0	chill	
W04-43	Summit Lake	unfed fry	196,000	1,1,1H		0	chill	
W04-44	Banks Lake	fed fry	300,000	3,1,1H		0	chill	
W04-45	Banks Lake	fed fry	1,000,000	1,3,1H		0	chill	
W04-46	Onion Creek	fed fry	500,000	H3,3	0		chill	
W04-47	Hawk Creek	fed fry	1,300,000	H1,3,2	0		chill	
I04-01	Lake Pend Oreille	fed fry	19,300,000	H1,1,2	0		chill	
I04-02	Lake Pend Oreille	fed fry	1,000,000	H1,1,2	0		chill	
W04-48	Big Sheep Creek	fed fry	500,000	1,2,1H		0	chill	