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*Releases of Thermally Marked Salmon from Alaska and  
Washington in 1999*

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## **Abstract**

In the States of Washington and Alaska, mass marking salmon through the method of otolith thermal marking is proving to be an effective research and management tool in a variety of situations. However the specific needs and applications for marking are not same in each state. This document contains a summary of thermal mark patterns applied to salmon stocks from the 1998 brood year and released in late 1998 and 1999.

## **Summary of Alaska thermal marking programs**

In Alaska, the primary use of thermal marking is to provide information about the contribution of hatchery fish, primarily pink, chum and sockeye, to commercial and cost-recovery fisheries during the summer fishing season. Several on-going programs use this information as an aid in the inseason management of mixed stock fisheries and hatcheries use the information to evaluate the success of various release strategies. In research applications, thermal marks have been used to answer questions regarding lake survival and to provide information on straying rates of returning adults. In addition the presence of otolith thermal marks is being used to determine the origin of juvenile and immature salmon obtained in high seas collections. In 1999, Alaska hatcheries released approximately 550 million thermal marked pink salmon, 160 million chum salmon, and 15 million sockeye salmon. In addition, approximately 400,000 coho and 50,000 chinook salmon were thermally marked and released.

Forty distinct groups from the 1998 brood year were assigned thermal patterns. Table 1 presents the thermal mark pattern used in these releases as represented by the Rbr notation (Munk and Geiger 1998), with a slight modification where narrow ring spacing is denoted by 'n' to aid in electronic communication (Hagen 1999). The pattern is also shown graphically with the location of the thermal pattern identified as either pre hatch or post hatch. The patterns applied during the 1998 brood year have not been fully evaluated for mark quality. In addition the number of marked fish released by each hatchery operator has not been finalized, though indications are that the number of marked fish should be similar to those from the 1997 brood year (Geiger and Munk 1998). Information regarding thermal marked patterns and numbers of released fish in Alaska is available from the Alaska Dept. of Fish and Game's Coded Wire Tag and Otolith Processing Laboratory database. In addition, attention should be directed to a prototype web page put together by the Pacific States Marine Fisheries Commission as another way to share mark information between thermal marking states and countries. The prototype page is available for examination at <http://www.psmfc.org/rmpc/iatmo/>.

Preliminary assignment of thermal patterns to be applied to the 1999 brood year stocks for release in 2000 is shown in table 2. There is expected to be increase in the number of marking groups to 45 as a result of programs proposed by hatcheries new to thermal marking. In these cases, simple patterns will be applied with the primary emphasis on evaluating the hatchery's ability to control temperatures to produce good marks prior to developing extensive recovery programs.

## **Summary of Washington thermal marking programs**

In Washington State, mass-marking of hatchery salmon with thermally-induced otolith marks (Volk et al., 1990) is primarily focussed toward evaluating the success of hatchery supplementation efforts associated with declining stocks and to answer a number of specific research questions where identification of hatchery fish at various life history stages is important. Otolith marks have also been employed to evaluate stray rates, select adults for spawning in mixed-stock hatchery spawning aggregations and as an aid to pre-season and in-season management of fisheries. In late 1998 and 1999, the Washington Department of Fish and Wildlife (WDF&W) and Washington State Indian Tribes released approximately 5,900,000 thermally-marked chinook, 9,885,000 sockeye, 27,000 coho and 590,000 chum salmon.

Table 3 summarizes releases of otolith-marked fish from WDF&W and Tribal Hatcheries in 1999. With one exception, fish were marked with brief exposures to chilled water events timed to encode a specific bar-code pattern (Volk et al., 1994). Each pattern was unique to a particular release time, location or size for groups of fish within the stock being marked. Marks were applied in both the pre- and post-hatch regions of the growing otolith, normally using 3 or 4 thermal events in the pre-hatch region and six or more events in the post-hatch region. Because emphasis on otolith thermal marking in Washington State is focussed upon identification of many groups within a stock rather than mixed fisheries with potential contributions from many hatcheries, marks are often redundant between hatchery stocks.

Marking of brood year 1999 fish is expected to be similar in scope to that reported above.

## **References**

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- Volk, E.C., S.L. Schroder, J.J. Grimm, and H.S. Ackley, 1994. The Use of Bar Code symbology to Produce Multiple Thermally Induced Otolith Marks. *Transaction of the American Fisheries Society* 123:811-816

Table 1. Summary of thermal mark codes applied to the 1998 brood year hatchery salmon in Alaska by geographic area.

**SOUTHEAST**

HATCHERY OPERATOR	MARKING FACILITY	SPECIES	STOCK	RELEASE SITE	REARING TREATMENT	RELEASE DISPOSITION	RBR		Prehatch		Posthatch	
DIPAC	Gastineau H.	CHINOOK		Gastineau		smolt	1:1.5					
DIPAC	Gastineau H.	CHUM		Amalga	late/large	net pen	1:1.4+2.6					
DIPAC	Gastineau H.	CHUM		Amalga		net pen	1:1.4					
DIPAC	Gastineau H.	CHUM		Boat Harbor		net pen	1:1.4+2.5					
DIPAC	Gastineau H.	CHUM		Gastineau		net pen	1:1.4+2.3					
DIPAC	Gastineau H.	CHUM		Limestone		net pen	1:1.4+2.4					
DIPAC	Gastineau H.	COHO		Gastineau		smolt	1:1.5					
DIPAC	Gastineau H.	PINK		Gastineau		fry	1:1.4+2.6					
DIPAC	Snettisham CIF	SOCKEYE	Snett	Speel Arm	early/small	smolt	1:1.3,2.3n					
DIPAC	Snettisham CIF	SOCKEYE	Snett	Speel Arm	late/small	smolt	1:1.4,2.4n					
DIPAC	Snettisham CIF	SOCKEYE	Snett	Speel Arm	late/lg	smolt	1:1.3,2.4					
DIPAC	Snettisham CIF	SOCKEYE	Snett	Speel Arm	early/large	smolt	1:1.4,2.3					
DIPAC	Snettisham CIF	SOCKEYE	Snett	Sweetheart		fry	1:1.5,2.3n					
DIPAC	Snettisham CIF	SOCKEYE	Tahltan	Tahltan		fry	1:1.7					
DIPAC	Snettisham CIF	SOCKEYE	Tahltan	Tuya		fry	1:1.4					
DIPAC	Snettisham CIF	SOCKEYE	Tatsamenie	U Tatsamenie		fry	1:1.4+2.3					
DIPAC	Snettisham CIF	SOCKEYE	Tatsamenie	U Tatsamenie		fry	1:1.4+2.5					
NSRAA	Hidden Falls	CHINOOK		Hidden Falls		smolt	1:1.4,2.2					
NSRAA	Medvejie	CHINOOK		Medvejie		smolt	1:1.3,2.3					
NSRAA	Hidden Falls	CHUM		Hidden Falls		net pen	1:1.3,2.3					
POWHA	Klawock	SOCKEYE	Klawock	Klawock Lake		fry	2:1.6					
SSRAA	Burnett Inlet	SOCKEYE		Hugh Smith Lake	a	early presmolt	1:1.5,2.3					
SSRAA	Burnett Inlet	SOCKEYE		Hugh Smith Lake	b	late presmolt	1:1.5,2.4					

**SOUTHCENTRAL**

CIAA	Trail Lakes	COHO	Bear L.	Bear L.			1:1.6				
CIAA	Trail Lakes	SOCKEYE	Tustumena	Tustumena		smolt	2:1.3,2.3				
CIAA	Trail Lakes	SOCKEYE	Big L.	Big L.		fry	1:1.3,2.2				
CIAA	Trail Lakes	SOCKEYE	Bear L.	Bear L.		smolt	1:1.6				
CIAA	Trail Lakes	SOCKEYE	Hidden Lake	Hidden L.		fry	1:1.4,2.2				
PWSAC	WHN	CHUM		WHN	a	net pen	1:1.3,2.4				
PWSAC	WHN	CHUM		WHN	b	net pen	1:1.3,2.2				
PWSAC	WHN	CHUM		PORT CHALMERS	a	net pen	1:1.6				
PWSAC	WHN	CHUM		PORT CHALMERS	b	net pen	1:1.6,2.2				
PWSAC	AFK	PINK		AFK	a		1:1.4				
PWSAC	AFK	PINK		AFK	b		1:1.4+2.3				
PWSAC	AFK	PINK		AFK	c		1:1.4+2.4				
PWSAC	AFK	PINK		AFK	c		1:1.4+2.3,2				
PWSAC	CCH	PINK		CCH	a		1:1.3,2.3				
PWSAC	WHN	PINK		WHN	a		1:1.8				
PWSAC	WHN	PINK		WHN	b		1:1.8+2.3				
VFDA	SGH	PINK		SGH			1:1.6				

Table 2. Summary of thermal mark codes to be applied to the 1999 brood year hatchery salmon in Alaska by geographic area. Data is preliminary.

SOUTHEAST												
HATCHERY OPERATOR	MARKING FACILITY	SPECIES	STOCK	RELEASE SITE	REARING TREATMENT	RELEASE DISPOSITION	RBR	Prenatch	Postnatch			
Amstrong-Keta	Port Armstrong	COHO		Port Armstrong			1:1.3					
Amstrong-Keta	Port Armstrong	PINK		Port Armstrong	fry		1:1.3					
DIPAC	Gastineau H.	CHINOOK		Gastineau	smolt		1:1.4					
DIPAC	Gastineau H.	CHUM		Arnalga	late/large		1:1.6+2.6					
DIPAC	Gastineau H.	CHUM		Arnalga			1:1.6					
DIPAC	Gastineau H.	CHUM		Gastineau			1:1.6+2.3					
DIPAC	Gastineau H.	CHUM		Limestone			1:1.6+2.5					
DIPAC	Gastineau H.	CHUM		Boat Harbor			1:1.6+2.4					
DIPAC	Gastineau H.	COHO		Gastineau			1:1.4					
DIPAC	Gastineau H.	PINK		Gastineau			1:1.4					
DIPAC	Snettisham CIF	SOCKEYE	Snelt	Speel Arm	early/small	smolt	1:1.4,2.4					
DIPAC	Snettisham CIF	SOCKEYE	Snelt	Speel Arm	late/small	smolt	1:1.4,2.3n					
DIPAC	Snettisham CIF	SOCKEYE	Snelt	Speel Arm	late/lg	smolt	1:1.3,2.4n					
DIPAC	Snettisham CIF	SOCKEYE	Snelt	Speel Arm	early/large	smolt	1:1.3,2.3					
DIPAC	Snettisham CIF	SOCKEYE	Snelt	Sweetheart			1:1.5,2.3					
DIPAC	Snettisham CIF	SOCKEYE	Tatsamenie	U. Tatsamenie			2:1.6,2.3					
DIPAC	Snettisham CIF	SOCKEYE	Tatsamenie	U. Tatsamenie	fed		2:1.6,2.5					
DIPAC	Snettisham CIF	SOCKEYE	Tahltan	Tahltan			2:1.7					
DIPAC	Snettisham CIF	SOCKEYE	Tahltan	Tuva			2:1.4					
NSRAA	Hidden Falls	CHINOOK		Hidden Falls			1:1.4,2.2					
NSRAA	Medvejie	CHINOOK		Medvejie			1:1.3,2.3					
NSRAA	Hidden Falls	CHUM		Hidden Falls			1:1.3,2.3					
NSRAA	Hidden Falls	CHUM		Deep Inlet			1:1.4,2.3					
POWHA	Klawock	SOCKEYE	Klawock	Klawock Lake			1:1.5					
SSRAA	Burnett Inlet	SOCKEYE		Hugh Smith Lake	a		1:1.3,2.2,3.2					
SSRAA	Burnett Inlet	SOCKEYE		Hugh Smith Lake	b		1:1.3,2.2,3.3					
SSRAA	Burnett Inlet	SOCKEYE		Neck Creek			1:1.3,2.1,3.3					
SSRAA	Burnett Inlet	SOCKEYE		McDonald Lake			1:1.3,2.1,3.4					
SOUTHCENTRAL												
CIAA	Trail Lakes	COHO	Bear L.	Bear L.			1:1.6					
CIAA	Trail Lakes	SOCKEYE	Tustumena	Tustumena			2:1.3,2.3					
CIAA	Trail Lakes	SOCKEYE	Big L.	Big L.	fry		1:1.3,2.2					
CIAA	Trail Lakes	SOCKEYE	Bear L.	Bear L.			1:1.6					
CIAA	Trail Lakes	SOCKEYE	Hidden Lake	Hidden L.			1:1.4,2.2					
PWSAC	WHN	CHUM		WHN			1:1.5					
PWSAC	WHN	CHUM		PORT CHALMERS		net pen	1:1.3					
PWSAC	WHN	COHO		WHN			1:1.3					
PWSAC	AFK	PINK		AFK	a		1:1.4					
PWSAC	AFK	PINK		AFK	b		1:1.4+2.3					
PWSAC	AFK	PINK		AFK	c		1:1.4+2.4					
PWSAC	CCH	PINK		CCH	a		1:1.3,2.3					
PWSAC	WHN	PINK		WHN	a		1:1.8					
PWSAC	WHN	PINK		WHN	b		1:1.8+2.3					
PWSAC	WHN	PINK		WHN	c		1:1.8+2.4					
PWSAC	Main Bay	SOCKEYE					1:1.3,2.2					
VFDA	SGH	PINK		SGH			1:1.6					

