

# Releases of otolith marked salmon from Russia for brood years 1994-1999

by

E.Akinicheva and A.Rogatnykh

Pacific Research Fisheries Center,  
Magadan Branch, Magadan, Russia

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### **Abstract**

Marking of the bred salmon is used to explore migrations and survival of the salmon in the ocean, determine the portion of this fish in the mixed stocks and estimate the efficiency of artificial reproduction efforts. Otolith marking programs are being implemented in the Magadan, Kamchatka and Sakhalin regions of Russia. We use both thermal and dry methods. Approximately, 91 million salmon with otolith marks were released in Russia in 1995-2000.

At present time, the most widespread method of mass salmon marking is the otolith thermal marking. Developed by the American scientists, this method was generally accepted in the US (Volk et al., 1990; Munk, Geiger, 1998). First industrial marking was carried out at hatcheries of the Washington State in 1987.

In recent years, some other, alternative to thermal, methods of otolith marking were developed. American scientists proposed to use strontium chloride (Shroder et al., 1994), and the Russian specialists introduced dry otolith marking method (Akinicheva et al., 1998; Safronenkov et al., 1999). This enabled the fish farmers of the Pacific countries to use three methods of salmon otolith marking – thermal, strontium-based and dry.

In Russia, the experiments associated with otolith thermal marking were commenced at hatcheries of the Magadan Region in 1992. Otolith marking on industrial scale was conducted since 1994. Different hatcheries use positive and negative temperature gradient marking techniques. At some hatcheries fish farmers use special boiler-type water-heating systems. The other hatcheries equipped with two water-supply systems providing for different temperature conditions (e.g. from the river and from water-wells) use alternating water-supply. Dry otolith marking on industrial scale was conducted in Russia since 1998. This method allows to mark embryos separately in each incubator box within optimum period of time.

Approximately, 54 million salmon with otolith marks were released from the hatcheries of Magadan, Kamchatka and Sakhalin in spring, 2000. Both thermal and dry methods were employed for otolith marking using different time intervals. The Russian types of otolith marks differ from Japanese in a number of rings in the first band.

The data on types of otolith marks and quantity of marked fish of brood years 1994 – 1999 are represented in the Table.

## Otolith marks released of salmon from Russia

BROOD YEAR	YEAR OF RELEASE	SPECIES	COUNTRY	FACILITY	AGENCY	RELEASE SITE	REARING TREATMENT	STAGE	NUMBER OF TM RELEASED	RBr	TERMAL MARK SCHEDULE	TEMP SHIFT DIRECTION
1	2	3	4	5	6	7	8	9	10	11	12	13
1994	1995	Coho	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	20 000	1[1.6]	(6X)24C:24H	doun 3 C
1994	1995	Chum	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	800 000	1[1.6]	(6X)24C:24H	doun 3 C
1995	1996	Chum	Russia	Yana Hatchery	ORV -Mo TINRO	Tauy Bay	fed	fry	7 759 000	1[1.6]	(6X)24C:24H	doun 2.5 C
1995	1996	Chum	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	4 000 000	1[1.3]	(3X)24H:24C	up 3.5C
1996	1997	Coho	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	629 000	1[1.6n+2.3]	(5X)12C:12H,(1X)12C:48H,(3X)24C:24H	doun 3 C
1996	1997	Chum	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	2 430 000	1[1.6n+2.3]	(5X)12C:12H,(1X)12C:48H,(3X)24C:24H	doun 3 C
1996	1997	Coho	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	400 000	1[1.4]	(4X)24H:24C	up 3.5C
1996	1997	Sockeye	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	281 000	1[1.4]	(4X)24H:24C	up 3.5C
1996	1997	Chum	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	100 000	1[1.5]	(5X)24H:24C	up 3C
1996	1997	Chum	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	11 456 000	1[1.3] and 2[1.3]	perhatch (3X)24H:24C and posthatch(3X)24H:24C	up 3.5C
1997	1998	Chum	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	668 000	1[1.3n+2.3n]	(2X)12C:12H,(1X)12C:36H,(3X)12C:12H	doun 2.5 C
1997	1998	Pink	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	2 100 000	1[1.3n+2.3n]	(2X)12C:12H,(1X)12C:36H,(3X)12C:12H	doun 2.5 C
1997	1998	Coho	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	649 000	1[1.3n+2.3n]	(2X)12C:12H, (1X)12C:36H, (3X)12C:12H	doun 2.5 C
1997	1998	Chum	Russia	Ola Hatchery	ORV -Mo TINRO	Tauy Bay	fed	fry	70 000	1[1.5]	(5X)24D:24W	dry
1997	1998	Chum	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	1 000 000	1[1.2+3.6]	(2X)24H:48C,(6X)24H:24C	up 3.5C
1997	1998	Chum	Russia	Ola Hatchery	ORV -Mo TINRO	Tauy Bay	fed	fry	200 000	1[1.7]	(7X)24H:24C	up 3.5 C
1997	1998	Sockeye	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	350 000	1[1.5]	(5X)24H:24C	up 3.5 C
1997	1998	Chum	Russia	Tauy Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	196 000	1[1.3+2.3]	(2X)24H:24C,(1X)24H:72C,(3X)24H:24C	up 2.7C
1997	1998	Pink	Russia	Tauy Hatchery	ORV - M0TINRO	Tauy Bay	fed	fry	850 000	1[1.3+2.3]	(2X)24H:24C, (1X)24H:72C,(3X)24H:24C	up 2.7C
1998	1999	Chum	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	146 000	1[1.12]	(12X)24D:24W	dry
1998	1999	Chum	Russia	Ola Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	200 000	1[1.4+2.3+3.2]	(3X)24D:24W,(1X)24D:72W,(2X)24D:24W), (1X)24D:120W,(2X)24D:24W	dry
1998	1999	Pink	Russia	Ola Hatchery	MoTINRO	Tauy Bay	fed	fry	650 000	1[1.3]	(3X)24D:24W	dry
1998	1999	Chum	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	965 000	1[1.2n+2.4n]	(1X)12C:12H, (1X)12C:48H, (4X)12C:H	doun 2-1.5 <sup>0</sup> C
1998	1999	Coho	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	683 000	1[1.2n+2.4n]	(1X)12C:12H, (1X)12C:48H, (4X)12C:H	doun 2-1.5 <sup>0</sup> C
1999	2000	Chum	Russia	Arman Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	4 100 000	1[1.5n]	(5X)12H:12C	up3 C
1999	2000	Chum	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	39 100	1[1.6]	(6X)24D:24W	dry
1999	2000	Coho	Russia	Yana Hatchery	ORV - MoTINRO	Tauy Bay	fed	fry	130 700	1[1.6]	(6X)24D:24W	dry
1999	2000	Chum	Russia	Ola Hatchery	MoTINRO	Tauy Bay	fed	fry	302 000	1[1.5]	(5X)24D:24W	dry
1999	2000	Pink	Russia	Ola Hatchery	MoTINRO	Tauy Bay	fed	fry	130 000	1[1.5]	(5X)24D:24W	dry
1999	2000	Chum	Russia	Ola Hatchery	MoTINRO	Tauy Bay	fed	fry	112 000	1[1.5n]	(5X)12D:12W	dry
1999	2000	Chum	Russia	Ola Hatchery	MoTINRO	Tauy Bay	fed	fry	43 000	1[1.5n+2.17]	(4X)12D:12W,(1X)12D:36W,(16X)24D:24W	dry

1	2	3	4	5	6	7	8	9	10	11	12	13
1999	2000	Chum	Russia	Ola Hatchery	ORV -MoTINRO	Tauy Bay	fed	fry	3 500 000	1[1.5]	(5X)24H:24C	up 3.5 <sup>0</sup> C
1999	2000	Chum	Russia	Tauy Hatchery	ORV -MoTINRO	Tauy Bay	fed	fry	740 000	1[1.5+2.2]	(4X)24H:24C,(1X)24H:48C,(2X)24H:24C	up
1999	2000	Sockeye	Russia	Malky Hatchery	KamchatRV - KamchatNIRO	r. Bolshaya	fed	fry	770 000	1[1.3+2.3]	(2X)24H:24C,(1X)24H:56C,(3X)24H:24C	up 3.0 <sup>0</sup> C
1999	2000	Chinook	Russia	Malky Hatchery	KamchatRV - KamchatNIRO	r. Bolshaya	fed	fry	486 000	2[1.3+2.5]	(2X)24C:24H,(1X)24C:56H,(5X)24C:24H	doun
1999	2000	Chum	Russia	Ozerky Hatchery	KamchatRV - KamchatNIRO	r. Bolshaya	fed	fry	422 000	1[1.3+2.2]	(2X)24D:24W,(1X)24D:72W,(2X)24D:24W	dry
1999	2000	Chum	Russia	Ozerky Hatchery	KamchatRV - KamchatNIRO	r. Bolshaya	fed	fry	95 000	1[1.3n]	(3X)12D:12W	dry
1999	2000	Sockeye	Russia	Ozerky Hatchery	KamchatRV - KamchatNIRO	r. Bolshaya	fed	fry	91 890	1[1.3+2.2]	(2X)24D:24W,(1X)24D:72W,(2X)24D:24W	dry
1999	2000	Chum	Russia	Ketkino Hatchery	KamchatRV - KamchatNIRO	r. Avacha	fed	fry	621 000	1[1.3+2.4]	(2X)24D:24W,(1X)24D:48W,(4X)24D:24W	dry
1999	2000	Pink	Russia	Bereznykovsky Hatchery	SakhRV - SakhNIRO	Okhotsk sea	fed	fry	14 056 200	1[1.3]	(3X)24H:24C	up
1999	2000	Pink	Russia	Bereznykovsky Hatchery	SakhRV - SakhNIRO	Okhotsk sea	fed	fry	2 418 000	2[1.2]	(2X)24H:24C	up
1999	2000	Chum	Russia	Bereznykovsky Hatchery	SakhRV - SakhNIRO	Okhotsk sea	fed	fry	22 546 100	1[1.4]	(4X)24H:24C	up
1999	2000	Pink	Russia	Bereznykovsky Hatchery	SakhRV - SakhNIRO	Okhotsk sea	fed	fry	1 256 850	1[1.3+2.1]	(2X)12D:36W,(1X)12D:50W,(1X)24D:24W	dry
1999	2000	Pink	Russia	Aniva Hatchery	SakhRV - SakhNIRO	Aniva Bay	fed	fry	700 000	1[1.3+2.3]	(2X)12D:24W,(1X)12D:72W,(3X)24D:24W	dry
1999	2000	Pink	Russia	Aniva Hatchery	SakhRV - SakhNIRO	Aniva Bay	fed	fry	500 000	1[1.3+2.3]	(2X)24D:24W,(1X)24D:72W,(3X)24D:24W	dry
1999	2000	Pink	Russia	Lesnoy Hatchery	SakhRV - SakhNIRO	Okhotsk sea	fed	fry	1 252 000	3[1.3+2.2]	perhatch (3X)24H:24C + posthatch (2X)24H:24C	up

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Наиболее распространенный способ массового мечения лососей в настоящее время – термическое маркирование отолитов (otolith thermal marking). Этот метод разработан американскими учеными и получил широкое распространение в США (Volk et al., 1990; Geiger, Munk 1998). Первое мечение в промышленных масштабах проведено на рыбоводных заводах штата Вашингтон в 1987г.

В последние годы разработаны методы маркирования отолитов, альтернативные термическому. Американскими учеными предложен способ с использованием хлорида стронция (Schroder et al, 1995), а русскими специалистами – метод сухого маркирования отолитов (Akinicheva et al, 1998; Safronenkov et al, 1999). Таким образом, в настоящее время рыбоводы в странах тихоокеанского региона используют три способа маркирования отолитов лососей – термическое, с помощью стронция и сухое.

В России эксперименты по термическому маркированию отолитов начаты на рыбоводных заводах Магаданской области в 1992г., с 1995г. проводится мечение в промышленных масштабах. На разных рыбоводных заводах проводят мечение с положительным и мечение с отрицательным градиентом температур. Для изменения фоновой температуры на одних заводах используют специальные системы для подогрева воды (типа бойлеров). На других, где имеются две системы водоподачи с различными температурными режимами (например из реки и из скважин), применяют переменное водоснабжение. С 1998г. в России в промышленном масштабе проводится маркирование отолитов лососей сухим способом. При этом возможно осуществлять мечение эмбрионов (embryos) отдельно в каждом инкубаторе в оптимальные сроки.

Весной 2000г. с рыбоводных заводов Магадана, Камчатки и Сахалина выпущено около 54 миллионов лососей с метками на отолитах. Мечение проводили как термическим, так и сухим методом с использованием различных временных интервалов. Российские типы меток отличаются от японских числом полос в первом блоке (number of rings in the first band).

Данные о типах меток и количестве выпущенных меченых рыб поколений 1994-1999гг. (brood years 1994-1999) представлены в таблице.