

**Releases of Thermally Marked Salmon from Japan
in 2000**

by

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Abstract

From March to June 2000, approximately 14.5 million chum and 1 million pink salmon (1999 brood year) with one of ten thermal mark patterns were released from five hatcheries in Hokkaido. The initial aim of thermal mark programs is to provide information for the ocean migration and survival of each regional salmon stock in Japan. Two types of computer-based water temperature control system were used to produce thermal marks in the otoliths of chum and pink salmon. Two rings as base mark were adopted to distinguish Japanese salmon from other stocks, because this code was not commonly used due to its illegibility. To increase available thermal mark patterns, we employed narrow rings, which were formed at 12 h intervals. To establish the international database of thermal mark releases, this document provided information of Japanese thermal marks releases, including release site, date, number, and mark patterns with images.

Introduction

Mass marking of hatchery salmon using otolith thermal marks is an effective tool for stock identification of salmon in high seas (Ignell et al., 1997; Kawana et al., 1999; Urawa et al., 1999) and coastal waters (Hagen et al., 1995; Farley and Munk, 1997; Farley et al., 1999).

In Japan, the initial aim of thermal mark programs is to provide information for the ocean migration and survival of each regional salmon stocks, combining with coastal and high-seas salmon researches. Thus we are planning to increase the number of thermal mark releases from hatcheries (Urawa et al., 2000).

Methods

Two types of water temperature control system were used for 1999 brood year stocks. A computer-programmed chiller with heater system installed at Chitose and Ichani Hatcheries can keep programmed temperature constant by recycling the water from the incubator. On the other hand, a computer-controlled chiller system installed at Shizunai Hatchery makes relatively cooler (4°C cooler) water from original water, and does not recycle the water from the incubator.

Few mark patterns are available when ring number is limited (Hagen, 1999). To increase available patterns, we employ narrow ring spacing, which is formed at 12 h intervals by computer-programmed water temperature control systems. The RBr code scheme is used to describe thermal patterns (Munk and Geiger, 1998). Two rings as base mark were adopted to distinguish Japanese salmon from other stocks, because this code was not commonly used due to its illegibility.

Releases of 1999 Brood Year Stocks

From March to June 2000, approximately 14.5 million chum and 1 million pink salmon (1999 brood year) with one of ten thermal mark patterns were released from five hatcheries in Hokkaido (Table 1, Fig. 1). The qualities of these thermal marks were good except for two poor marks: Shizunai99chum (early) and Shikiu99chum (Yurappu, late). Part of the releases marked as Shizunai99chum (early) may be detected as unmarked for the thermal rings were faint (Fig. 1B). Shikiu99chum (Yurappu, late) was difficult to discriminate from natural noise pattern, because the thermal mark pattern might be detected as three rings in one band without equal spacing (Fig. 1G). We had planned to employ three rings in the second band for this stock, but the egg condition was not good and had insufficient period for marking. Thus we stopped marking for Shikiu99chum (Yurappu, late) after first ring in the second band.

Acknowledgments

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References

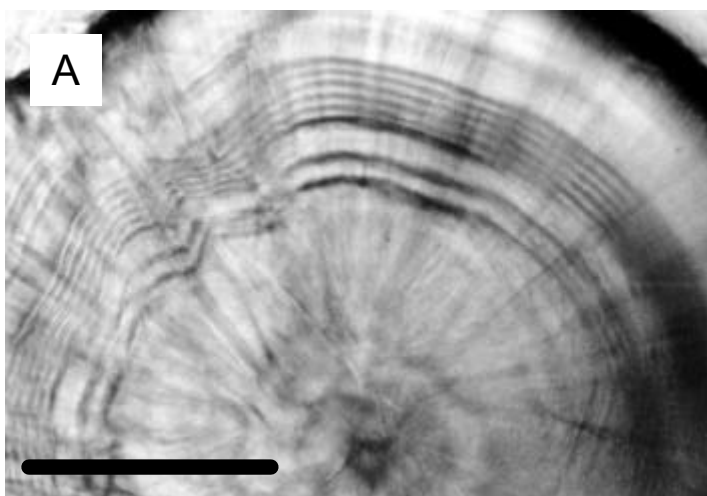
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Table1. Otolith thermal mark releases of chum and pink salmon from Japan in 2000.

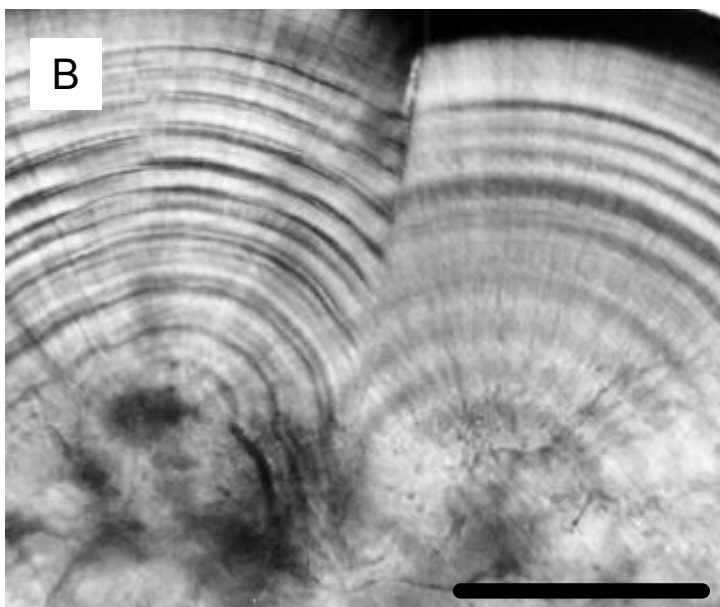
No	BROOD YEAR	DATE OF RELEASE	SPECIES	COUNTRY	STATE/ PROVINCE	REGION	AGENCY	FACILITY	STOCK	FINAL RELEASE SITE
J-1	1999	3/16/00 - 4/10/00	CHUM	JAPAN	HOKKAIDO	Japan Sea coast	NASREC	Chitose Hatchery	Ishikari River	Chitose River of Ishikari River system
J-2	1999	5/19/00 - 5/22/00	CHUM	JAPAN	HOKKAIDO	West Pacific coast	NASREC	Shizunai Hatchery	Shizunai River	Shizunai River
J-3	1999	3/3/00 - 5/17/00	CHUM	JAPAN	HOKKAIDO	West Pacific coast	NASREC	Shizunai Hatchery	Shizunai River	Shizunai River
J-4	1999	5/10/00	CHUM	JAPAN	HOKKAIDO	West Pacific coast	NASREC	Shizunai Hatchery	Shizunai River	Shizunai River
J-5	1999	5/31/00 - 6/3/00	CHUM	JAPAN	HOKKAIDO	West Pacific coast	NASREC	Shikiu Hatchery	Shikiu River	Shikiu River
J-6	1999	4/20/00 - 5/31/00	CHUM	JAPAN	HOKKAIDO	West Pacific coast	NASREC	Shikiu Hatchery	Yurappu River	Shikiu River
J-7	1999	4/20/00 - 5/31/00	CHUM	JAPAN	HOKKAIDO	West Pacific coast	NASREC	Shikiu Hatchery	Yurappu River	Shikiu River
J-8	1999	5/1/00	CHUM	JAPAN	HOKKAIDO	Nemuro Strait coast	NASREC	Kunbetsu Hatchery	Kunbetsu River	Kunbetsu River
J-9	1999	4/19/00 - 5/31/00	CHUM	JAPAN	HOKKAIDO	Nemuro Strait coast	NASREC	Ichani Hatchery	Ichani River	Ichani River
J-10	1999	5/19/00	PINK	JAPAN	HOKKAIDO	Nemuro Strait coast	NASREC	Ichani Hatchery	Ichani River	Ichani River

No	TM ID	RBr	PREHATCH GRAPHIC	POSTHATCH GRAPHIC	REARING TREATMENT	STAGE	MEAN SIZE AT RELEASE (mm)	MEAN SIZE AT RELEASE (g)	ACTUAL NUMBER OF TM RELEASED
J-1	Chitose99chum	1:1.2, 2.6n			fed	fry	49	0.95	4,914,000
J-2	Shizunai99chum (early)	1:1.2, 2.3			fed	fry	65	2.13	311,000
J-3	Shizunai99chum	1:1.2, 2.3			fed	fry	-	1.74	3,113,000
J-4	Shizunai99chum (late)	1:1.2, 2.3+3.5			fed	fry	63	2.06	15,000
J-5	Shikiu99chum	1:1.2, 2.3n -3.3n			fed	fry	64	1.93	824,000
J-6	Shikiu99chum (Yurappu, early)	1:1.2, 2.3n -3.5n			fed	fry	42	0.55	360,000
J-7	Shikiu99chum (Yurappu, late)	1:1.2, 2.1n			fed	fry	43	0.57	378,000
J-8	Kunbetsu99chum	1:1.2, 2.4n			fed	fry	49	1.00	1,085,000
J-9	Ichani99chum	1:1.2, 2.8n			fed	fry	54	1.09	3,503,000
J-10	Ichani99pink	1:1.2, 2.6n			fed	fry	53	0.87	985,000

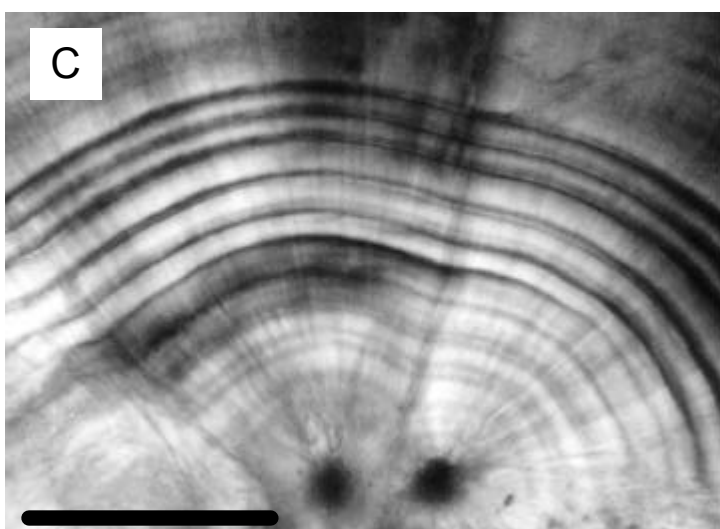
No	THERMAL MARK SCHEDULE	MARKING SYSTEM	TEMP SHIFT DIRECTION	DIGITAL PHOTO IMAGE	MARK QUALITY	COMMENTS
J-1	(1X)24C:24H,(1X)24C:48H,(6X)12C:12H	CHILLER	down (8-4C)	yes	good	
J-2	(2X)24H:24C,(1X)48H:24C,(2X)24H:24C	CHILLER	up (6-10C)	yes	poor	rings are faint
J-3	(1X)24C:24H,(1X)24C:48H,(3X)24C:24H	CHILLER	down (10-6C)	yes	good	
J-4	(1X)24C:24H,(1X)24C:48H,(2X)24C:24H,(1X)24C:360H,(5X)24C:24H	CHILLER	down (10-6C)	yes	good	
J-5	(1X)24C:24H,(1X)24C:48H,(2X)12C:12H,(1X)12C:36H,(3X)12C:12H	CHILLER	down (8-4C)	yes	good	
J-6	(1X)24C:24H,(1X)24C:48H,(2X)12C:12H,(1X)12C:36H,(5X)12C:12H	CHILLER	down (8-4C)	yes	good	
J-7	(2X)24H:24C,(1X)48H:12C	HEATER	up (8-12C)	yes	poor	looks like noise pattern, 3 rings not equal spacings
J-8	(1X)24C:24H,(1X)24C:48H,(3X)12C:12H	CHILLER	down (8-4C)	yes	good	
J-9	(1X)24C:24H,(1X)24C:48H,(8X)12C:12H	CHILLER	down (8-4C)	yes	good	
J-10	(1X)24C:24H,(1X)24C:48H,(6X)12C:12H	CHILLER	down (8-4C)	yes	good	



Chum salmon
Ishikari River
Chitose99chum
RBr=1:1.2.2.6n

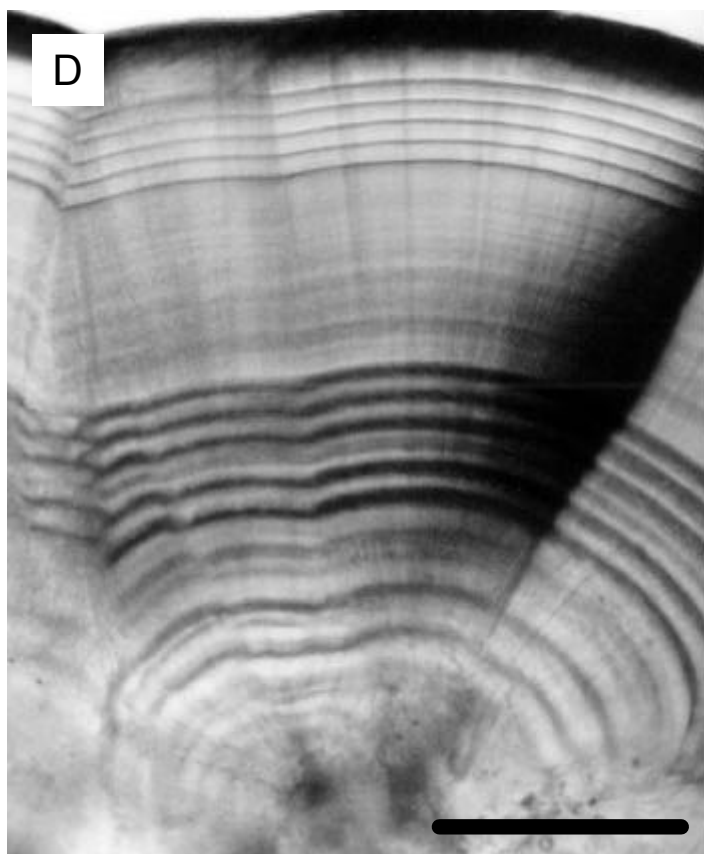


Chum salmon
Shizunai River
Shizunai99chum (early)
RBr=1:1.2,2.3

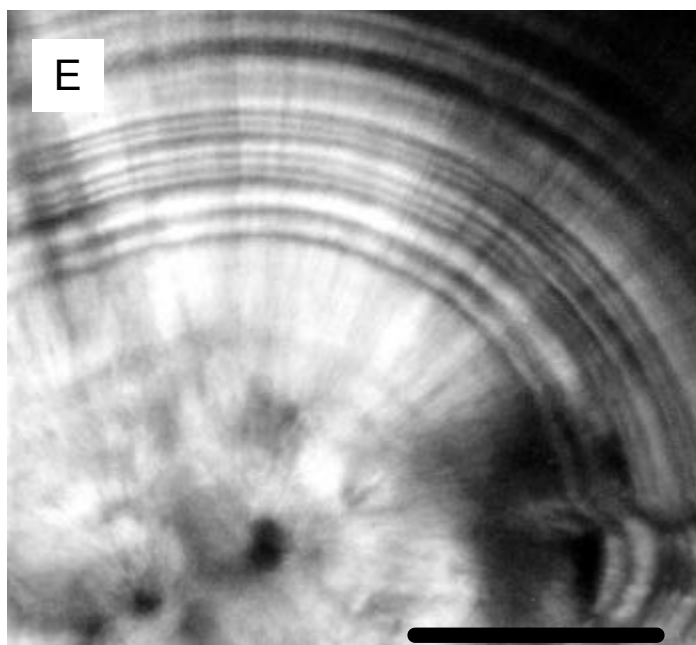


Chum salmon
Shizunai River
Shizunai99chum
RBr=1:1.2,2.3

Fig. 1. Thermal mark patterns of chum and pink salmon released from Japan in 2000. (bar=50 μ m).

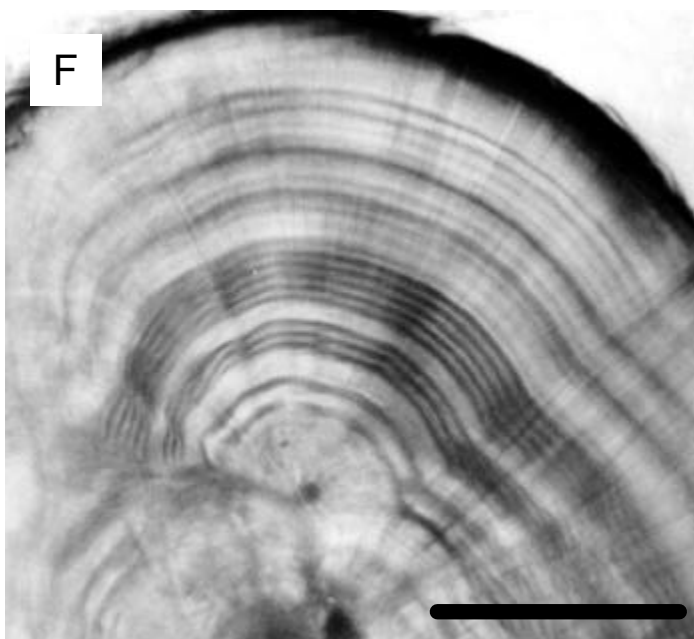


Chum salmon
Shizunai River
Shizunai99chum (late)
RBr=1:1.2,2.3+3.5

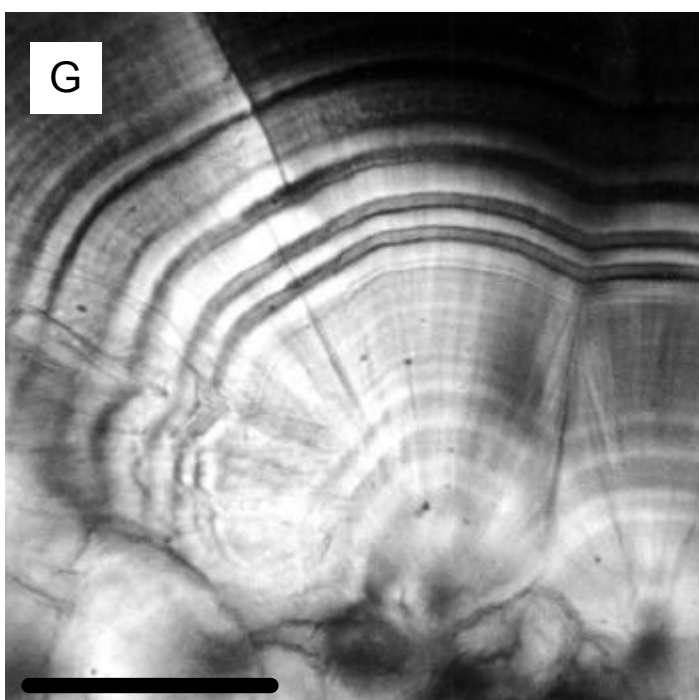


Chum salmon
Shikiu River
Shikiu99chum
RBr=1:1.2,2.3n-3.3n

Fig. 1. Continued.

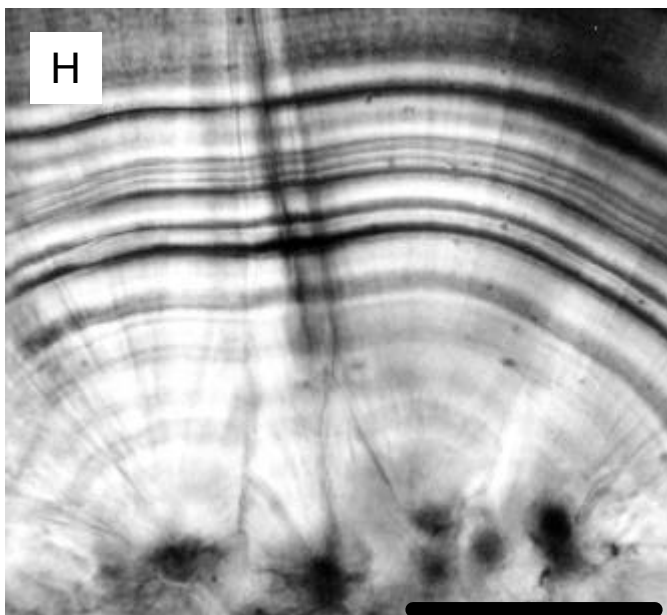


Chum salmon
Shikiu River
Shikiu99chum (Yurappu, early)
RBr=1:1.2,2.3n-3.5n

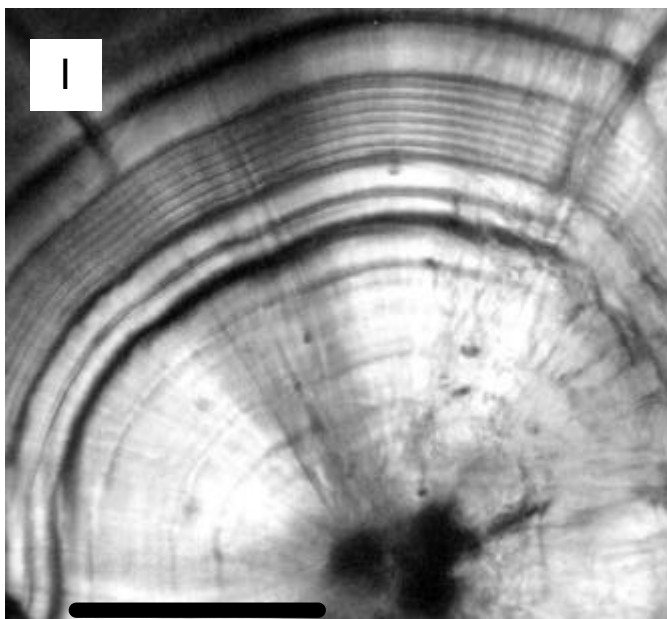


Chum salmon
Shikiu River
Shikiu99chum (Yurappu, late)
RBr=1:1.2,2.1n

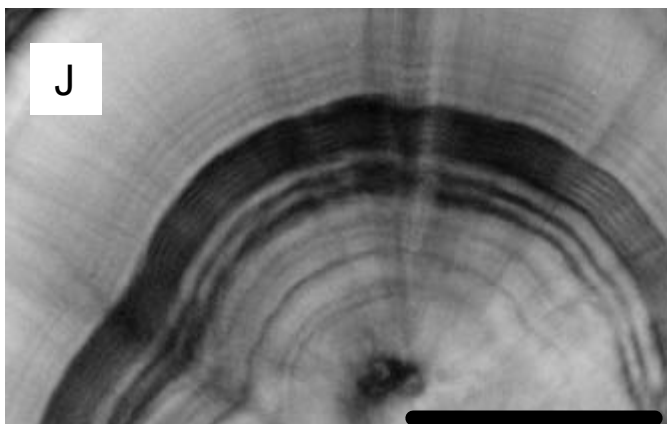
Fig. 1. Continued.



Chum salmon
Kunbetsu River
Kunbetsu99chum
RBr=1:1.2,2.4n



Chum salmon
Ichani River
Ichani99chum
RBr=1:1.2,2.8n



Pink salmon
Ichani River
Ichani99pink
RBr=1:1.2,2.6n

Fig. 1. Continued.