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by

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Thermally-Marked Maturing Pink Salmon in the Gulf of Alaska in the Summer of 1998

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Abstract

Twenty-nine thermally-marked pink salmon (*Oncorhynchus gorbuscha*) were found among 383 maturing fish (1996 brood year stocks) caught in two offshore transects (165°W and 145°W) in the Gulf of Alaska during June and July 1998. In 165°W transect (n=76), 4 thermally-marked pink salmon (5.3%) were found and their origins were Armin F. Koering Hatchery (AFK, n=1), Cannery Creek Hatchery (CCH, n=2), and Wally H. Noerenberg Hatchery (WHN, n=1). In 145°W transect (n=307), 25 thermally-marked pink salmon (8.1%) were found and their origins were AFK (n=8), CCH (n=9), and WHN (n=8). These hatcheries are located in Prince William Sound (PWS) in southcentral Alaska. A CPUE composition of the marked fish caught by research gillnets indicated that hatchery fish of PWS origins were relatively abundant in northern waters of each transect maybe due to their homeward migrations. In 165°W transect, thermally-marked hatchery fish of PWS origins were found in offshore waters (47-50°N), which extended the known ocean range of maturing pink salmon of southcentral Alaska in summer.

Introduction

Recently, mass-marking of hatchery stocks using thermal marking of otoliths for in-shore fisheries management has become increasingly popular in Alaska (Hagen et al., 1995; Geiger and Munk, 1998). Thermal marks are also an effective tool for stock identification in high-seas and coastal waters (Farley and Munk, 1997; Ignell et al., 1997). This is a report of detection of thermally-marked maturing pink salmon (*Oncorhynchus gorbuscha*) in the Gulf of Alaska in the summer of 1998.

Materials and Methods

Sagittal otoliths were collected from maturing pink salmon (n=383) caught by gillnets (A-, C-, and F-gears) in two offshore transects (165°W and 145°W) by T/S *Oshoro maru* in the Gulf of Alaska during June and July 1998 (Walker et al., 1998). The otoliths were cleaned and stored dry in 96-cell trays with individual sample labels. Left otoliths were mounted on individually labeled glass slides using thermoplastic cement. If the left otolith was missing or ground through the primordia, then the right otolith was used. Otoliths were ground to expose the primordia and examined under the microscope. Thermal marks recovered were in the RBr code structure (Munk and Geiger, 1998). In case the same RBr code was used for a brood year class at different hatcheries, the microstructural patterns were compared with voucher specimens that were collected from the hatcheries before release.

Results and Discussion

Twenty-nine thermally-marked pink salmon from the 1996 brood were found from 383 fish examined (Table 1, Fig. 1). In 165°W transect (n=76), 4 thermally-marked fish (5.3%) were found and their origins were Armin F. Koering Hatchery (AFK, n=1), Cannery Creek Hatchery (CCH, n=2), and Wally H. Noerenberg Hatchery (WHN, n=1). In 145°W transect (n=307), 25 thermally-marked fish (8.1%) were found and their origins were AFK (n=8), CCH (n=9), and WHN (n=8).

These marked fish were released from Prince William Sound (PWS, in southcentral Alaska) where all pink salmon (n=483.70 million) released from 4 hatcheries were thermally-marked for 1996 brood year stocks (McNair, 1998; Munk and Geiger, 1998). However, marked fish released

from Solomon Gulch Hatchery (SGH, n=188.86 million, 39% of released fish from PWS hatcheries) and Gastineau Hatchery (GH, n=5.90 million, southeast Alaska) were not found in the samples. Two plausible explanations for the lack of GH stock in these samples are: 1) relatively low mark number, and 2) wide geographical separation of natal systems. SGH in PWS released the greatest number of thermal marks among 4 PWS hatcheries, with good quality reported in the thermal marks. However, the run-timing of SGH stock is approximately 3-4 weeks prior to that of the other three hatchery stocks.

A catch per unit effort (CPUE) composition of the marked fish caught in 30 tans of research gillnets (C-gear) indicated that hatchery fish of PWS origins were abundant in the northern part of each transect (Fig. 2). This may be due to their homeward migrations. In the Myers' (1994) model on ocean distribution and migrations of pink salmon originating in southwestern, central, and southeastern Alaska based on recoveries of tagged fish released in 1972-1992, which were adapted and updated from Takagi et al. (1981), pink salmon are not distributed south of 50°N around 165°W. However, in this study, 4 thermally-marked hatchery fish released from PWS were found in offshore waters (47 - 50°N, 165°W), which extended the known ocean range of maturing pink salmon of southcentral Alaska in summer.

References

Farley, E. V., and K. Munk. 1997. Incidence of thermally marked pink and chum salmon in the coastal waters of the Gulf of Alaska. Alaska Fish. Res. Bull., 4: 181-187.

Geiger, H. J., and K. Munk. 1998. Otolith thermal mark release and mass-processing history in Alaska (USA), 1988-1998. (NPAFC Doc. 368) Alaska Department of Fish and Game, CWT & Otolith Processing Lab, Juneau. 9 p.

Hagen, P. K. Munk, B. V. Alen, and B. White. 1995. Thermal mark technology for inseason fisheries management: a case study. Alaska Fish. Res. Bull., 2: 143-155.

Ignell, S. E., C. M. Guthrie III, J. H. Helle, and K. Munk. 1997. Incidence of the thermally-marked chum salmon in the 1994-96 Bering Sea pollock B-season trawl fishery. (NPAFC Doc. 246) Auke Bay Laboratory, Alaska Fisheries Science Center, NMFS, NOAA, Juneau. 16 p.

McNair, M. 1998. Alaska salmon program 1997 annual report. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Juneau. 36 p.

Munk, K. M., and H. J. Geiger. 1998. Thermal marking of otoliths: the "RBr" coding structure of thermal marks. (NPAFC Doc. 367) Alaska Department of Fish and Game, CWT & Otolith Processing Lab, Juneau. 19 p.

Myers, K. W. 1994. New conceptual models of high-seas migrations of pink and chum salmon. In Proceedings of the 16th northeast Pacific pink and chum salmon workshop. University of Alaska Fairbanks, Fairbanks. pp. 83-96.

Takagi, K., K. V. Aro, A. C. Hartt, and M. B. Dell 1981. Distribution and origin of pink salmon (*Oncorhynchus gorbuscha*) in offshore waters of the North Pacific Ocean. Int. North Pac. Fish. Comm. Bull., 40: 195 p.

Walker, R. V., K. Y. Aydin, G. Anma, H. Yamaguchi, Y. Kamei, T. Shoji, M. Kaeriyama, and S. Urawa. 1998. The 1998 international cooperative salmon research cruise of the *Oshoro maru*. (NPAFC Doc. 349) FRI-UW-9812. University of Washington, Fisheries Research Institute, Seattle. 20 p.

Table 1. A list of thermally-marked pink salmon in the Gulf of Alaska during gillnet operations conducted by the T/S *Oshoro maru* in June and July 1998. F, female; M, male; FL, fork length; BW, body weight; AFK, Armin F. Koering Hatchery; CCH, Cannery Creek Hatchery; WHN, Wally H. Noerenberg Hatchery.

No.	Date	Latitude (°N)	Longitude (°W)	Gear (mm)	Sex	FL (mm)	BW (g)	Gonad weight (g)	Age	RBr	Hatchery origin
1	09-Jul-98	51°00	145°00	A115	F	502	1580	54	0.1	1:1.4+2.3	AFK96early
2	05-Jul-98	55°00	145°00	C106	F	454	1080	27	0.1	1:1.4+2.3	AFK96early
3	04-Jul-98	56°00	145°00	A121	F	432	900	37	0.1	1:1.4+2.3	AFK96early
4	04-Jul-98	56°00	145°00	C082	M	462	1040	11	0.1	1:1.4+2.3	AFK96early
5	08-Jul-98	52°00	145°00	C106	F	486	1480	48	0.1	1:1.4	AFK96late
6	05-Jul-98	55°00	145°00	C082	M	447	1040	18	0.1	1:1.4	AFK96late
7	05-Jul-98	55°00	145°00	A121	F	487	1240	41	0.1	1:1.4	AFK96late
8	04-Jul-98	56°00	145°00	C106	M	460	1220	1	0.1	1:1.4	AFK96late
9	27-Jun-98	50°00	165°00	C093	M	454	1240	29	0.1	1:1.4	AFK96late
10	10-Jul-98	50°00	145°00	A115	F	491	1520	46	0.1	1:1.3,2.3	CCH96
11	10-Jul-98	50°00	145°00	A115	F	498	1400	56	0.1	1:1.3,2.3	CCH96
12	05-Jul-98	55°00	145°00	C093	F	472	1360	105	0.1	1:1.3,2.2	CCH96
13	05-Jul-98	55°00	145°00	C106	M	448	1000	11	0.1	1:1.3,2.3	CCH96
14	05-Jul-98	55°00	145°00	C072	M	486	1160	15	0.1	1:1.4,2.3	CCH96
15	05-Jul-98	55°00	145°00	C082	M	437	960	13	0.1	1:1.4,2.3	CCH96
16	04-Jul-98	56°00	145°00	A121	F	505	1540	49	0.1	1:1.4,2.3	CCH96
17	04-Jul-98	56°00	145°00	A121	M	481	1320	15	0.1	1:1.4,2.3	CCH96
18	04-Jul-98	56°00	145°00	C106	M	442	960	8	0.1	1:1.3,2.3	CCH96
19	28-Jun-98	48°30	165°00	C121	M	470	1260	15	0.1	1:1.3,2.3	CCH96
20	28-Jun-98	48°30	165°00	C093	F	517	1540	22	0.1	1:1.3,2.3	CCH96
21	09-Jul-98	51°00	145°00	C106	F	483	1280	32	0.1	1:1.8	WHN96early
22	05-Jul-98	55°00	145°00	C106	M	467	1160	23	0.1	1:1.8	WHN96early
23	05-Jul-98	55°00	145°00	C063	F	469	1020	28	0.1	1:1.8	WHN96early
24	05-Jul-98	55°00	145°00	C082	M	458	1060	18	0.1	1:1.8	WHN96early
25	04-Jul-98	56°00	145°00	C082	M	447	1020	21	0.1	1:1.8	WHN96early
26	04-Jul-98	56°00	145°00	C106	F	518	1540	42	0.1	1:1.8	WHN96early
27	04-Jul-98	56°00	145°00	C106	M	476	1300	13	0.1	1:1.8	WHN96early
28	04-Jul-98	56°00	145°00	C106	M	470	1200	12	0.1	1:1.8+2.3	WHN96late
29	29-Jun-98	47°00	165°00	A115	F	457	1060	25	0.1	1:1.8+2.3	WHN96late

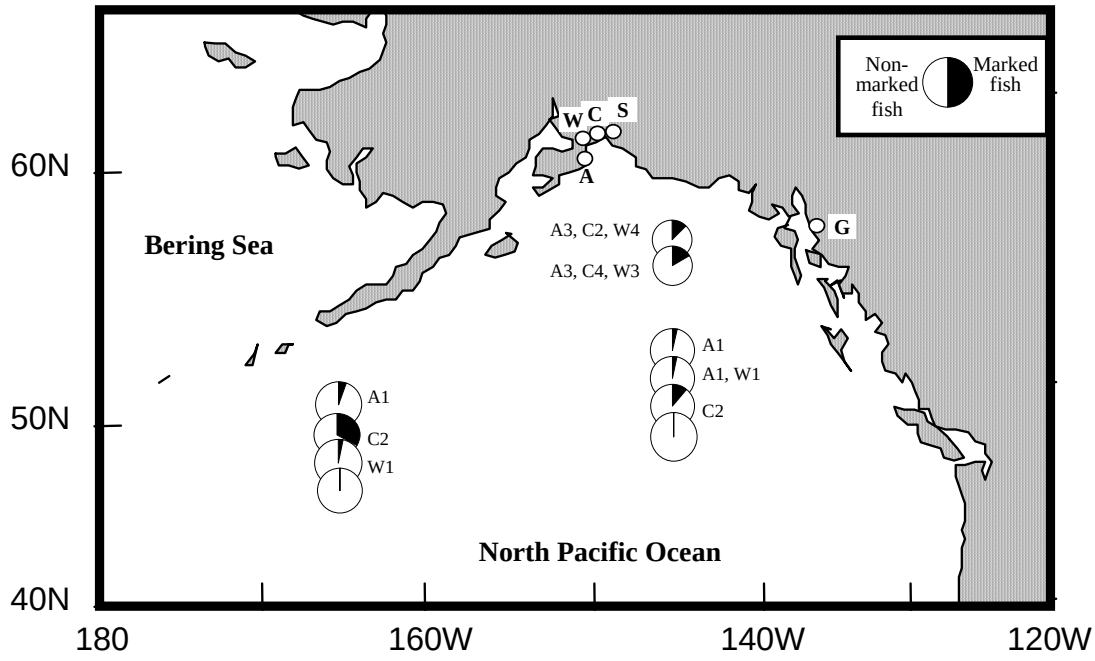

Fig. 1. Hatchery origins and composition of thermally-marked maturing pink salmon caught in 145°W and 165°W transects of the Gulf of Alaska in June and July 1998. A, Armin F. Koering Hatchery; C, Cannery Creek Hatchery; G, Gastineau Hatchery; S, Solomon Gulch Hatchery; W, Wally H. Noerenberg Hatchery.

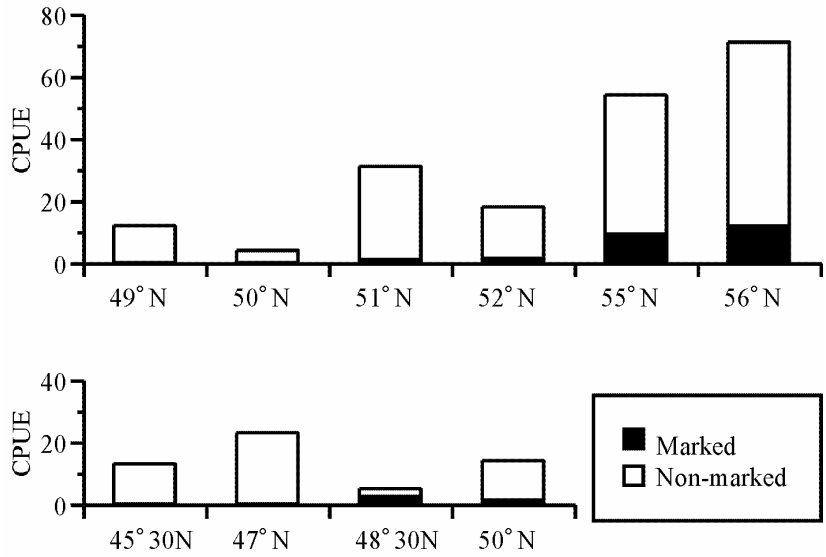

Fig. 2. Catch per unit effort (CPUE) of thermally-marked pink salmon caught in 145°W (upper) and 165°W (lower) transects of the Gulf of Alaska in June and July 1998. The CPUE values are based on catch number per research-mesh gillnets (C-gear, 30 tans).