RESEARCH NOTE

Biological Characteristics of Fall-Run Chum Salmon (*Oncorhynchus keta*) caught in the Lower Amur River

Kazumasa Ohkuma[*1], Toshiya Suzuki[*1], Kei Yurano[*2],
Sergey F. Zolotukhin[*3], and Victor G. Markovtsev[*4]

[*1]*Research Division, National Salmon Resources Center,*
2-2 Nakanoshima, Toyohira-ku, Sapporo 062-0922, Japan
(ohkuma@salmon.affrc.go.jp)
[*2]*Fisheries Agency of Japan, 1-2-1 Kasumigaseki, Tokyo 100-8905, Japan*
[*3]*Khabarovsk Branch, Pacific Research Fisheries Centre,*
9 Shevchenko Street, Khabarovsk 680000, Russia
[*4]*Pacific Research Fisheries Centre, 4 Shevchenko Alley, Vladivostok 690600, Russia*

Abstract. – Biological characteristics were examined for fall-run chum salmon (*Oncorhynchus keta*) caught by test and local fisheries in the lower Amur River during September 2000. Age 0.3 fish (56%) were the most abundant age group, followed by age 0.4 fish (38%). The average fork length and body weight were 66.8 cm and 3.91 kg for females, and 69.3 cm and 4.54 kg for males, respectively.

Key words : Amur River, chum salmon, fall run, biological characteristics

Introduction

The Amur River, one of the biggest rivers in eastern Asia, is famous and important for its summer- and fall-run chum salmon (*Oncorhynchus keta*). The name "*keta*" means "fish" in the language of the Nanai people who live along the Amur River (Salo 1991). The first Japan-Russia cooperative research program on Amur River chum salmon was conducted in 1999 for summer-run fish (Ishida et al. 2001). They investigated the biological characteristics of the summer-run chum salmon and reported large deviations in the sex ratio between sampling locations. We continue the cooperative research by examining the fall-run of chum salmon that returned in 2000 by describing biological characteristics such as fork length, body weight, gonadosomatic index, age, and sex ratio of fall chum salmon caught in the lower portion of the river. We compare these characteristics with previous information from older

studies and from recent data for summer-run chum salmon surveyed in 1999.

Materials and Methods

A total of 306 chum salmon were caught by drift gillnet (size: 6 m × 150 m) in the lower Amur River and the Amgun River on September 9-10, 2000 (Fig. 1). The stretched mesh size of the gillnet was 140 mm (70 mm by the Russian method of mesh measurement). The 247 fish caught at Tatarsk were measured for fork length (FL), scales were collected for age determination, and the sex was determined by visual examination. The European system was used to designate the fish's age, where counts of freshwater annuli and ocean annuli are identified and separated by a period. A subsample of 126 fish was measured for body (BW) and gonad weight (GW). Another sample of 40 fish caught at Tyr and 19 fish from the Amgun River, about 1 km upstream from the junction with the Amur River, were examined for FL, BW, and GW. Fork length was measured to the nearest 1 cm and BW was weighed to the nearest 0.1 kg. Gonad weight was weighed to the nearest 1 g using an electronic balance. The condition factor
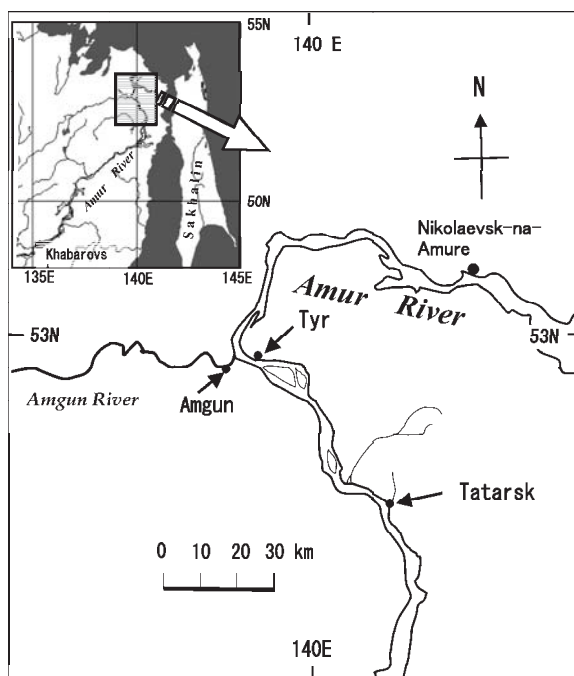
Fig. 1. Location of sampling sites in the lower Amur River for collection of fall-run chum salmon in September 2000.

Table 1. Sex ratio of fall-run chum salmon caught in the lower Amur River in September 2000.

Location	Female (%)	Male (%)	Number of samples
Tatarsk	60.3	39.7	247
Tyr	37.5	62.5	40
Amgun	47.4	52.6	19
Total	56.5	43.5	306

(CF) and gonadosomatic index (GSI) were calculated using following formulae:

$$CF = 10^6 \, BW/FL^3$$
$$GSI = GW/BW/10$$

Body weight and FL of age 0.3 and 0.4 fish were compared by sex using t-tests. The chi-square was used to test for differences in sex ratios.

Results

The sex ratio was 60.3% female and 39.7% male for chum salmon caught at Tatarsk, and 37.5% female and 62.5% male for the sample collected at Tyr (Table 1). In the Amgun River, the sex ratio was approximately even, although the sample size was small (n=19). Sex ratios were statistically significant by fishing location (chi-square, $p < 0.05$).

Total average fork length and body weight were 66.8 cm and 3.91 kg for females, and 69.3 cm and 4.54 kg for males, respectively (Table 2). Average condition factor was the same for males and females. The average gonadosomatic index is 10.6 and 4.04 for female and male fish, respectively. Those index show that the fish of both sexes were not fully matured yet.

The most abundant in the Tatarsk samples was age 0.3 fish, followed by age 0.4 (Fig. 2). At Tyr, the age composition had a high proportion of age 0.3 fish, followed by age 0.4 fish. The most abundant age class in the Amgun River sampls was age 0.3, followed by age 0.4 fish.
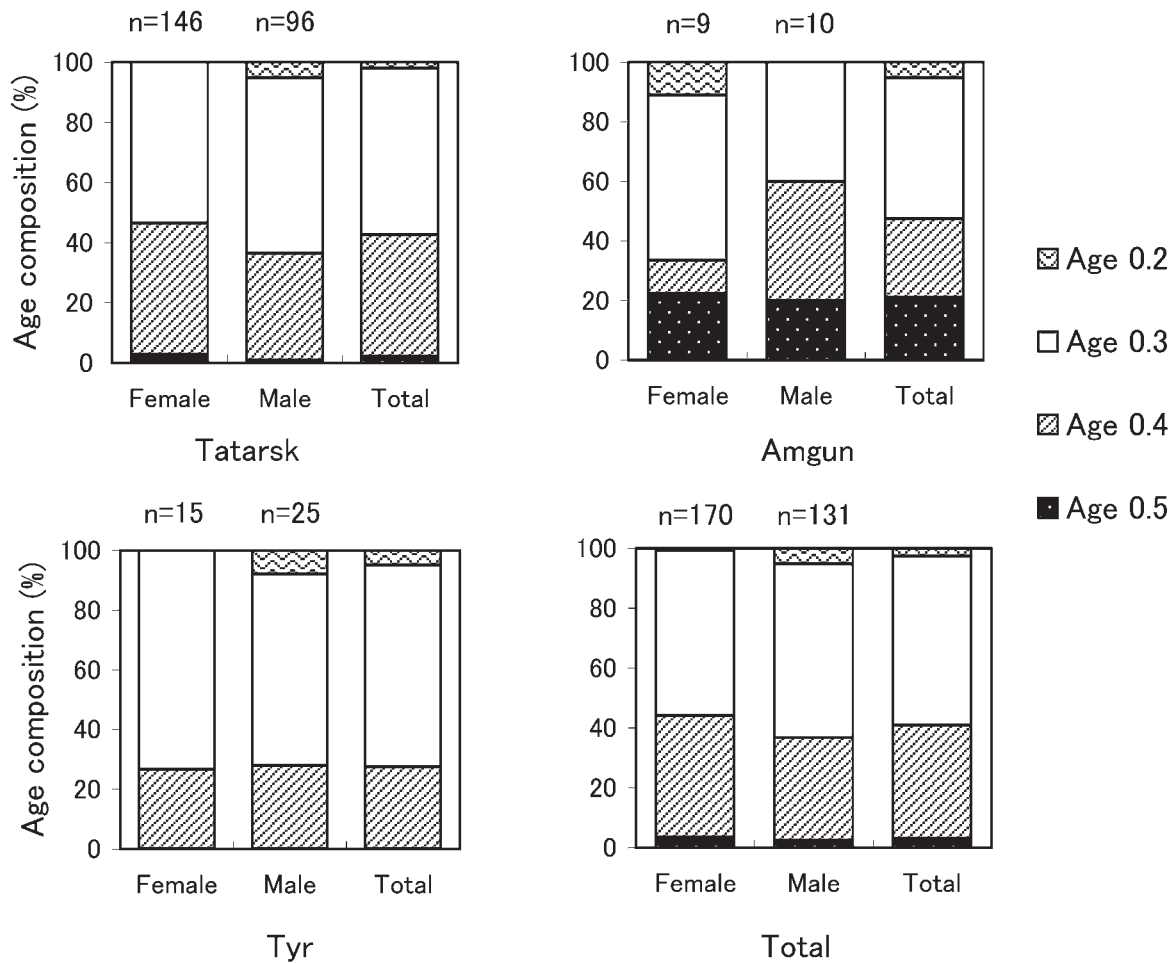
Table 2. Average fork length (FL), body weight (BW), condition factor (CF), and gonadosomatic index (GSI) of fall-run chum salmon caught in the lower Amur River in September 2002.

		Female				Male			
		Tatarsk	Tyr	Amgun	Total	Tatarsk	Tyr	Amgun	Total
FL (cm)	mean	66.7	68.2	66.0	66.8	69.3	69.4	70.0	69.3
	SD	4.03	2.73	1.66	3.87	6.39	5.68	5.54	6.16
	n	149	15	9	173	98	25	10	133
BW (kg)	mean	3.94	4.06	3.40	3.91	4.70	4.34	4.24	4.54
	SD	0.81	0.56	0.36	0.76	1.14	1.23	1.08	1.16
CF	mean	12.9	12.7	11.8	12.8	12.9	12.7	12.1	12.8
	SD	0.89	0.60	0.65	0.89	0.98	1.10	0.75	1.01
GSI	mean	10.8	8.9	11.9	10.6	4.1	4.1	3.8	4.04
	SD	2.38	1.91	2.58	2.44	0.78	0.59	0.86	0.74
	n	75	15	9	99	51	25	10	86

Fig. 2. Percent age composition of fall-run chum salmon caught in the lower Amur River in September 2000.

While the mean size of male chum salmon increased from age 0.2 fish to age 0.5 fish (Table 3),

Table 3. Average fork length (FL) and body weight (BW) of fall-run chum salmon caught in the lower Amur River in September 2000.

Age	FL (cm)			BW (kg)		
	mean	SD	n	mean	SD	n
Female						
0.5	68.2	2.7	6	3.30	0.28	2
0.4	66.7	3.9	69	3.91	0.87	44
0.3	66.7	4.0	94	3.93	0.68	51
0.2	66		1	3.1		1
Male						
0.5	76.0	2.0	3	5.30	0.26	3
0.4	71.0	6.7	45	4.77	1.24	33
0.3	68.4	5.8	76	4.41	1.09	44
0.2	65.0	3.4	7	3.13	0.69	4

the mean size of female did not increase by age so much. Sample sizes of age 0.3 and 0.4 fish were large enough for statistical analysis, and age 0.4 males were significantly larger than age 0.3 males ($p < 0.05$). However, no significant difference was observed in mean FL of females at age 0.3 and 0.4 ($p = 0.50$). Differences among male ($p = 0.09$) and female ($p = 0.45$) mean BW were not significant.

Discussion

Comparison of our age composition with data from 1959 (81.8% for age 0.3 and 7.2% for age 0.4; Sano 1966) shows the proportion of age 0.4 fish has increased since the earlier study and confirms the increase in mean age observed by Ishida et al. (1993). Regarding fish size, Ishida et al. (1993) reported the decreasing trend in body weight from the 1970s to 1980s. Our mean BW values for age 0.3 chum salmon caught in the lower Amur River

exceed the values obtained in the 1959 study (3.40 kg for female and 4.16 kg for male, Sano 1966).

In 1999 the proportion of female summer-run chum salmon was low (32-34%) at Tyr (Ishida et al. 2001). In autumn 2000 the proportion of females collected in Tyr was lower (37.5%) than the 60% females caught at Tatarsk. Male fish ascend the river earlier than female fish during their spawning migration (Bakkala 1970). However, it was difficult to conclude that female chum salmon outnumbered the males at Tatarsk, which is further up stream than Tyr. The predominance of females further upstream may be explained by the small number of fish examined at Tyr. Further studies are needed to clarify these issues.

Acknowledgements

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アムール川下流域で採捕した秋サケの生物学的特徴

大熊一正・鈴木俊哉・由良野圭・
Sergey F. Zolotukhin・Victor G. Markovtsev

2000年9月にアムール川下流域において秋サケの生物学的調査を行った．採捕された秋サケの鱗による年齢査定を行ったところ，0.3年魚（4年魚）が56％を占め，次いで0.4年魚（5年魚）が38％を占めた．調べたサケの平均体長および平均体重は雌で66.8 cm，3.91 kg，雄では69.3 cm，4.54 kgであった．