

## Results of Identification of Sockeye Salmon (*Oncorhynchus nerka*) Secondary Local Stocks and Secondary Groups of Local Stocks in the Coastal and River Catches of Kamchatka River for 1978–2001

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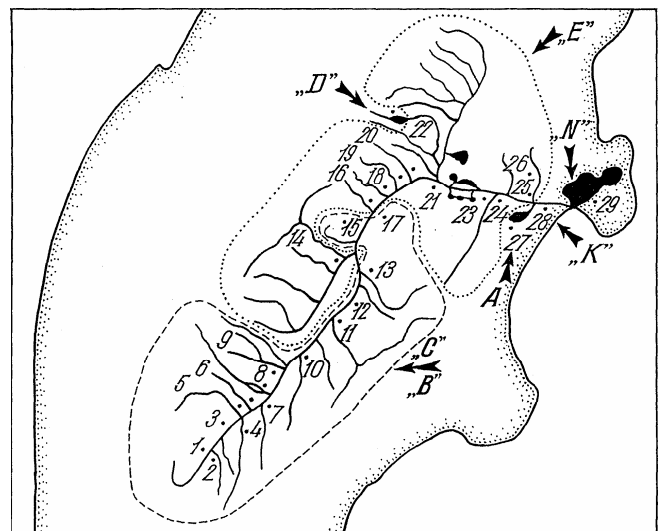
Sockeye salmon from the early run, spawning in the upper and middle tributaries of the Kamchatka River (Fig. 1), almost totally migrate to the sea in the year of their emergence from the gravel as underyearlings of 35–45 mm in length (“C” group). Juvenile sockeye salmon of the late run inhabiting this region feed in the vicinity of spawning grounds and migrate to the sea at age 1+ (“B” group). General sockeye salmon stock, spawning in the tributaries of the middle and low reaches of the Kamchatka River, migrates (as underyearlings) to the Azabachye Lake for feeding, situated in the low reaches of Kamchatka River (“E” group); a small number of underyearlings from this area migrates to Nerpichye Lake (“N” group) for feeding. At the same time, native sockeye salmon stock reproduces in the basin of Azabachye Lake, i.e. native juveniles spend two winters in the lake and migrate to the sea at age 2+ (“A” stock). “E” group smolts are of 1+ age. Aside from these stocks mentioned above, two native sockeye salmon stocks - Dvukhyrtochnoye Lake stock (“D” stock) and Nerpichye Lake stock (“N” stock) are in the basin of Kamchatka River. “D” stock smolts are of 2+ age, “N” stock and group are represented by the age 1+. In general, Kamchatka River sockeye salmon mature in three marine years.

The complex method of identification of sockeye salmon secondary stocks and secondary groups from the structure of scale fresh-water zone, the frequency of *Diphyllobothrium sp.* infection and the time of catching was worked out in 1980’s (Bugayev 1983, 1986). It has been shown that the fish from different stocks and groups enter the river at different times which results in their different contribution in the fishery catches. Total abundance of fishes (escapement and commercial catch) improved on the basis of the identification methods (Table 1) and provides the possibility of using the results in studying stock abundance dynamics of secondary stocks, secondary groups, and total Kamchatka River stock.

If data from Tables 1 and 2 are compared, one can see that the age and population composition of the catches and the relationship to the spawning stock is similar to that noted for Kamchatka River sockeye salmon long ago (Bugayev 1983).

Figure 2 shows sockeye salmon abundance of Kamchatka River total basin in 1957–2003.

**Fig. 1.** The Kamchatka River basin (diagrammatic) showing samplings sites for sockeye spawners: 1 – Puschino village, 2 – Kashkan River, 3 – Sharoma village, 4 – Kavycha River, 5 – Andrianovka River, 6 – Zhupanka River, 7 – Vakhvina River, 8 – Kirganik River, 9 – Kimitina River, 10 – Kitilgina River, 11 – Shchapina River, 12 – Nikolka River, 13 – Tolbachik River, 14 – Bystraya-Kozyrevka River, 15 – Sheklun River, 16 – Kreruk River, 17 – Ushkovskoye Lake springs, 18 – Kruki River, 19 – Polovinnaya River, 20 – Belaya River, 21 – Yelovka River, 22 – Dvukhyrtochnoye Lake, 23 – Bolshaya Khapitsa River, 24 – Malaya Khapitsa River, 25 – Raduga River, 26 – Azabachye Lake, 27 – Nizovtsevo Lake (Raduga River drainage), 28 – Kursin Lake, 29 – Soldatskaya River (Nerpichye Lake drainage). See text for description of groups A, B, C, D, E, and N.



**Table 1.** Percent contribution of secondary local stocks and secondary groups of local stocks by age structure of Kamchatka River sockeye salmon in the catches of marine trap net for 1978–1984 and 1985–2001.

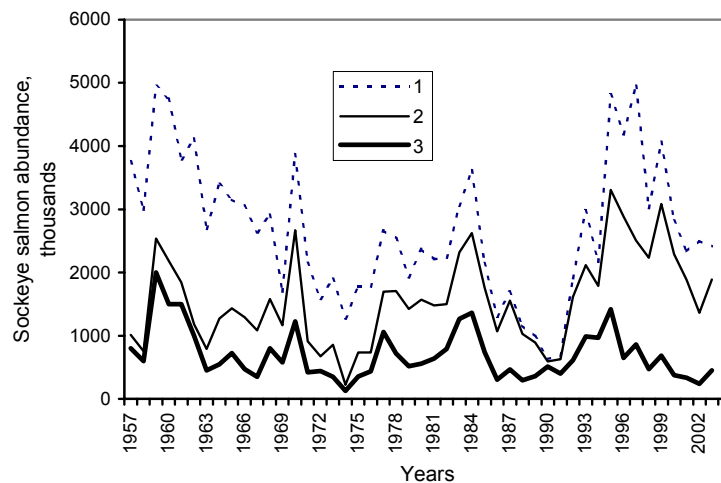
Years	0.3		1.3		2.3		Sample size
	C	B	E	N*	A	D	
Early run (June)							
1985	4.1	10.3	39.2	2.6	37.1	6.7	194
1986	12.0	10.9	26.1	3.6	26.6	20.8	192
1987	17.7	4.0	40.2	3.6	21.3	13.2	249
1988	22.1	3.1	29.5	6.3	23.2	15.8	95
1989	20.8	0.0	33.6	4.0	20.8	20.8	101
1990	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-
1992	12.1	1.6	26.1	2.8	51.0	6.4	249
1993	17.2	1.4	31.9	2.4	43.0	4.1	291
1994	16.7	4.2	33.3	2.1	42.7	1.0	96
1995	4.2	0.0	23.1	0.3	56.2	16.2	290
1996	5.8	1.6	31.3	0.8	52.3	8.2	243
1997	16.8	4.1	33.2	0.0	44.4	1.5	196
1998	9.5	5.4	29.9	3.2	47.9	4.1	465
1999	24.0	1.4	29.9	1.5	33.2	10.0	521
2000	24.2	6.1	31.2	2.1	32.6	3.8	475
2001	12.4	0.8	34.7	1.9	35.7	14.5	614
Mean							
1978–1984	9.9	6.2	51.8	2.4	25.7	4.0	
1985–2001	14.6	3.7	31.5	2.5	37.9	9.8	
Late run (July)							
1985	2.5	27.4	17.3	4.6	41.1	7.1	197
1986	4.3	16.1	34.4	4.9	32.8	7.5	186
1987	9.8	18.3	24.2	1.7	32.8	13.2	235
1988	10.2	24.5	23.1	4.8	33.3	4.1	147
1989	12.1	26.6	19.6	7.0	25.6	9.1	199
1990	-	-	-	-	-	-	-
1991	-	-	-	-	-	-	-
1992	6.1	6.1	18.4	1.0	68.4	0.0	98
1993	5.4	8.1	15.6	2.0	58.1	10.8	148
1994	8.3	9.7	25.5	3.4	49.7	3.4	145
1995	2.9	10.7	11.4	4.8	63.9	6.3	440
1996	3.2	6.4	23.3	0.5	60.2	6.4	533
1997	4.6	4.9	22.0	1.4	64.5	2.6	346
1998	7.3	10.7	19.6	5.7	53.7	3.0	439
1999	24.9	19.7	16.5	3.5	33.6	1.8	345
2000	6.8	24.4	19.0	1.6	44.5	3.7	512
2001	6.3	8.7	33.9	2.1	47.4	1.6	378
Mean							
1978–1984	11.1	19.3	38.3	3.9	22.6	4.8	
1985–2001	7.6	14.8	21.6	3.3	47.3	5.4	

Note.\* - individuals from "N" group and stock, none differentiated in the catches.

**Table 2.** Abundance ratio (%) by age structure of sockeye salmon escapement from secondary local stocks and groups in the basin of Kamchatka River for 1978–1984 and 1985–2001.

Years	0.3		1.3			2.3	
	C	B	E*	N**	K	A	D
1985	13.2	8.9	24.4	2.6(0.3)	0.1	38.4	12.4
1986	22.9	16.7	18.1	2.9(1.3)	0.1	25.9	13.4
1987	31.8	4.9	22.0	2.6(0.7)	0.2	28.6	9.9
1988	34.5	20.1	19.8	2.7(1.0)	0.4	15.7	6.8
1989	31.9	8.9	23.6	3.6(1.4)	0.2	14.1	17.7
1990	31.9	13.3	28.3	3.3(0.8)	0.1	13.1	10.0
1991	15.3	13.3	33.7	4.0(1.0)	0.3	23.4	10.0
1992	10.0	5.2	14.4	2.3(1.0)	m. d.	57.3	10.8
1993	20.4	2.7	20.2	2.0(0.2)	m. d.	39.9	14.8
1994	20.5	4.1	16.2	1.6(0.2)	m. d.	48.6	9.0
1995	7.5	4.0	25.1	2.6(0.4)	m. d.	48.7	12.1
1996	8.5	1.5	33.2	3.5(0.6)	m. d.	41.3	12.0
1997	11.3	2.4	22.8	2.3(0.3)	m. d.	54.6	6.6
1998	16.4	4.1	41.0	3.6(+)	m. d.	29.4	5.5
1999	18.2	4.7	42.9	3.7(+)	m. d.	18.8	11.7
2000	15.2	4.3	53.7	5.0(0.3)	m. d.	14.1	7.7
2001	4.8	2.7	51.1	4.4(+)	m. d.	22.7	14.3
Mean							
1970–1984	28.0	4.9	40.8	4.4(0.8)	0.2	16.4	5.3
1985–2001	18.5	7.2	28.8	3.1	m. d.	31.4	10.9

Note. \* - "N" group individuals are not included; \*\* - united abundance of sockeye salmon "N" stock and "N" group (the portion of the "N" stock is within the parentheses); m. d. - missing data. The sign "+" – less than 0.1%. Average meaning for the period 1985–2001 is not 100% due to missing data on the "K" stock for 1992–2001. Average abundance of sockeye salmon escapement in the basin of Kamchatka River for 1970–1984 – 685,000 and for 1985–2001 – 614,000.

**Fig. 2.** Sockeye salmon abundance of total Kamchatka River basin, 1957–2003: (1) maturation period in the sea before the drift net fishery; (2) run (coastal catch + escapement); (3) escapement.

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