# A Migration Model of Japanese Chum Salmon during Early Ocean Life

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The early ocean migration route of Japanese chum salmon (*Oncorhynchus keta*) was estimated by genetic stock identification techniques using allozyme (22 loci) variation. The baseline was improved by adding 19 Japanese populations to Seeb et al. (1997).

Juvenile chum salmon (age 0.0) were abundant in the Okhotsk Sea from August through October, but rarely caught in Pacific waters along Hokkaido and the Kuril Islands in autumn. In the southern Okhotsk Sea, juvenile chum salmon catches were composed of 79% Japanese fish in October (Fig. 1), but this stock component decreased to 56% in November (Fig. 2).

Due to decreasing seawater temperatures in the Okhotsk Sea, chum salmon moved into Pacific waters east of the Kuril Islands in late November (Fig. 2) and remained in the western subarctic gyre at high density during winter. These overwintering young salmon (age 0.1) comprised 34% Japanese and 59% Russian stocks in January, and 47% Japanese and 44% Russian stocks in February (Fig. 3).

In the following summer, the abundance of young chum salmon (age 0.1) was low in the North Pacific Ocean, but the abundance was high in the Bering Sea. Young chum salmon caught in the western and central North Pacific Ocean were predominately of Russian origin (52–77%), but those caught in the central Bering Sea were a mixture of Japanese (65%), Russian (25%), and Alaskan (10%) stocks (Fig. 4).

These results indicate Japanese chum salmon juveniles stay in the Okhotsk Sea from summer until late autumn, overwinter in the western North Pacific Ocean, and then migrate into the Bering Sea by the following summer (Fig. 5).

**Fig. 1.** CPUE distribution of juvenile chum salmon in the southern Okhotsk Sea during October 1993 (A), and estimated contributions of Asian stocks to the mixtures (B). Bars indicate SD CPUE = number of fish caught per 1 h trawl.

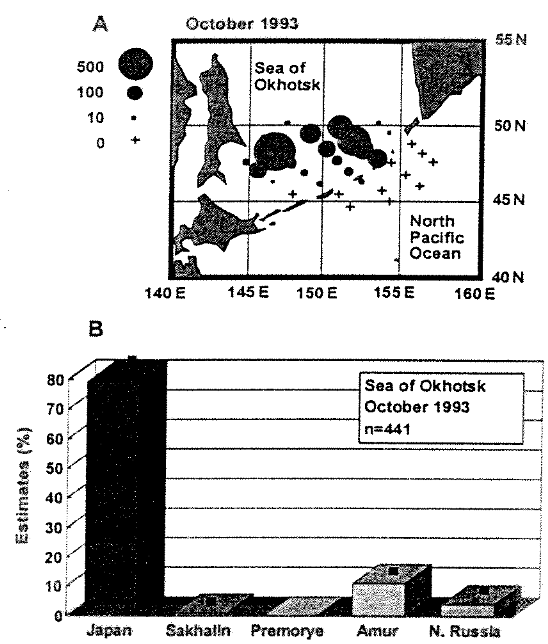


**Fig. 2.** CPUE distribution of juvenile chum salmon in the southern Okhotsk Sea and western North Pacific Ocean during November 1993 (A), and estimated contributions of Asian stocks to these mixtures (B and C). Bars indicate SD CPUE = number of fish caught per 1 h trawl.

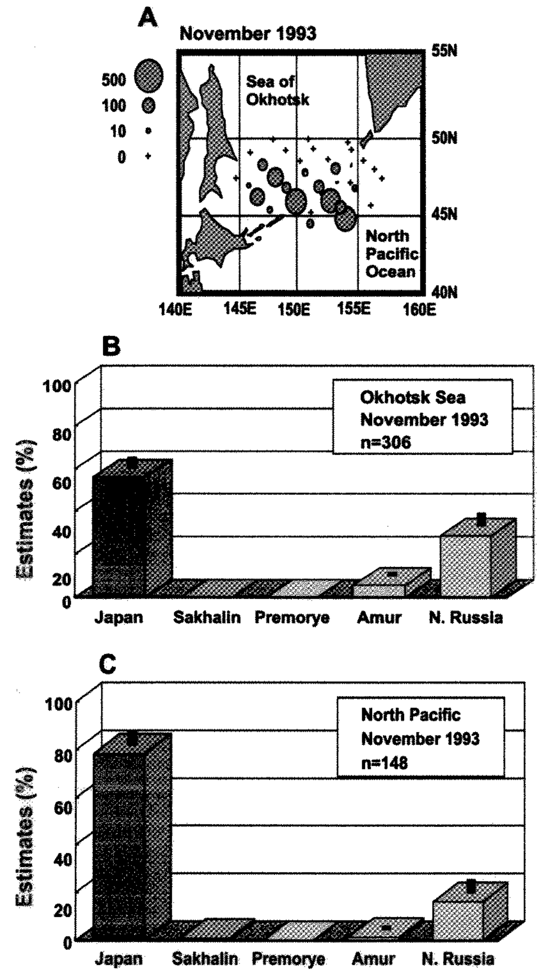



**Fig. 4.** Estimated average CPUE of age 0.1 chum salmon by stocks in the North Pacific Ocean and Bering Sea in the summers of 1996–99. CPUE = number of fish caught per a set of research gillnets (30 tans).

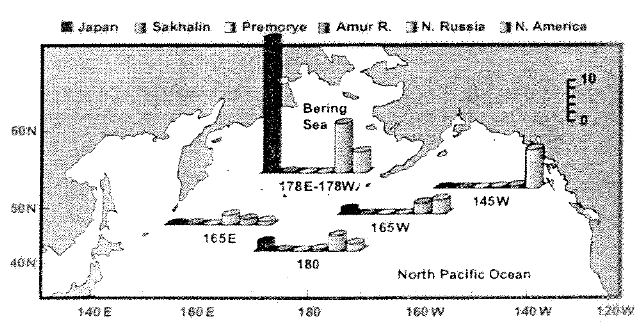



**Fig. 3.** CPUE distribution of age 0.1 chum salmon in the western North Pacific Ocean in January 1996 and February 1998 (A), and estimated contributions of Asian and North American stocks to these mixtures (B and C). Bars indicate SD CPUE = number of fish caught per 1 h trawl.

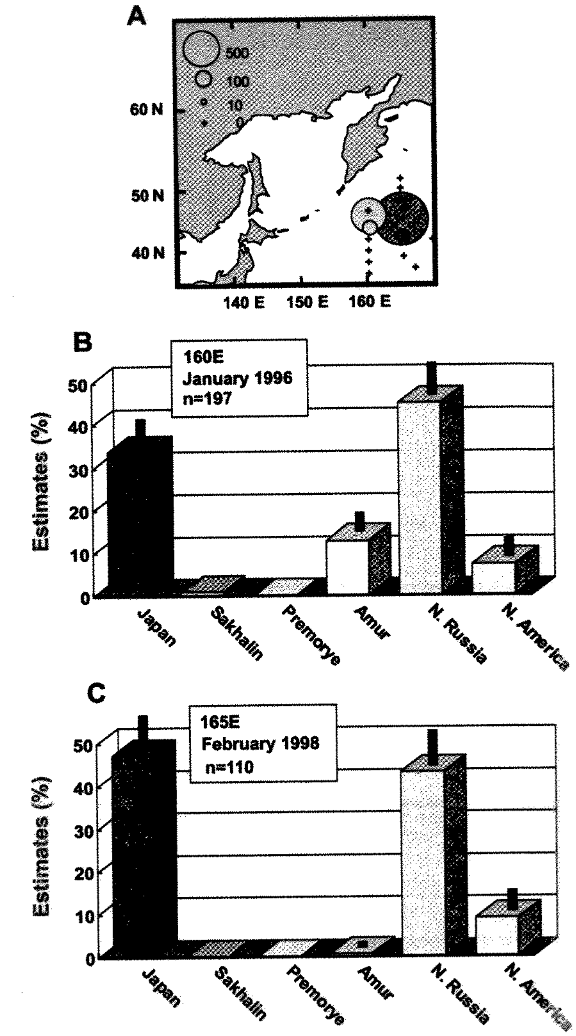
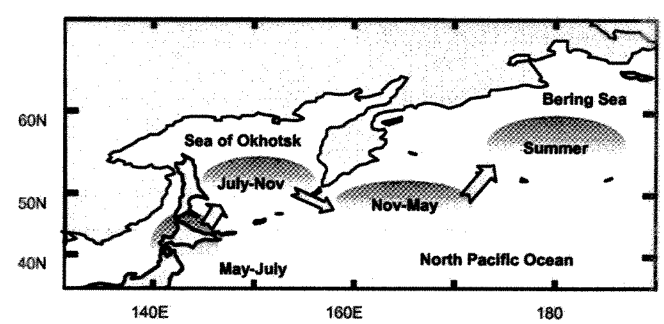



**Fig. 5.** A migration model of Japanese chum salmon during early ocean life.

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