

## Results of the Pioneering Studies of Pacific Salmon Early Marine Life on the Sakhalin Island Shelf

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The early marine life period of Pacific salmon is considered to be critical for the formation of their broodline numbers (Watanabe 2000). However, for a long time, this period was not investigated with research efforts concentrated in the offshore zone of far-eastern seas. It was believed that juveniles of the Sakhalin pink salmon stocks did not stay in the coastal zone for a long time. Migrations of 5–20 miles and more were thought to occur from the coast during the first days (Shershnev et al. 1982).

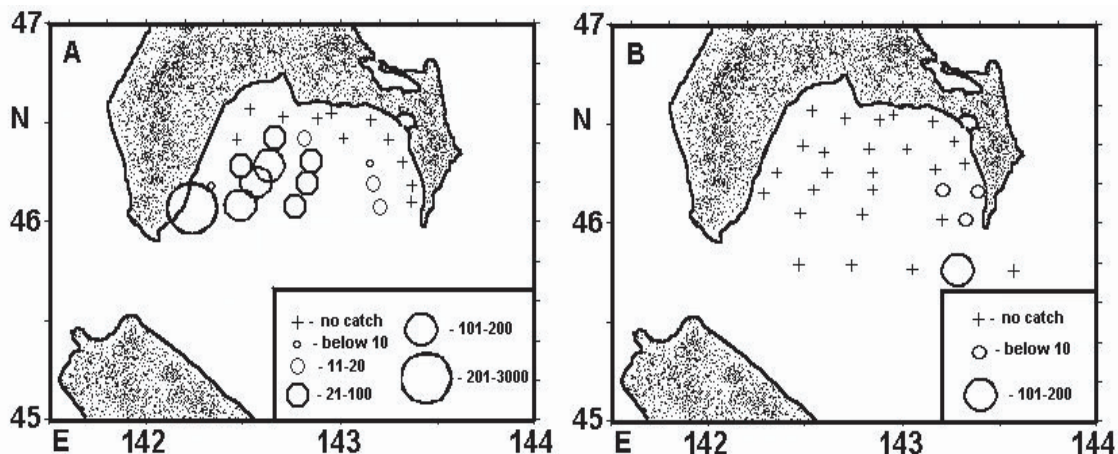
In 2002, SakhNIRO began a study of juvenile salmon in the Sakhalin-Kurile region from the board of R/V *Dmitry Peskov*. Since 2003, a pelagic trawl (54.4/192 m) with the fine mesh size insert in the codend was used to catch salmon. The net fished in an area of 0.17 km<sup>2</sup> during one half-hour. Calculations of juvenile pink salmon abundance were executed by the squares method assuming a trawl catch-ability coefficient of 0.1 for such small fish.

During June–July of 2002–2003, 337 trawl hauls were executed near the eastern Sakhalin and southern Kurile Islands. Juvenile salmon aggregations were not discovered on the shelf. In 2004, the survey area and schedule time were expanded. Waters around the southern Sakhalin were surveyed in June and July. During the cruise, 217 trawl operations were performed from 17 June to 31 July. Dense juvenile Pacific salmon aggregations were found in the Aniva Bay in the beginning of July. A total of 1671 juvenile pink, 425 juvenile chum, and 11 masu salmon were sampled (Shubin et al. 2005). We observed that juvenile Pacific salmon did not migrate from the inshore zone as early as previously believed.

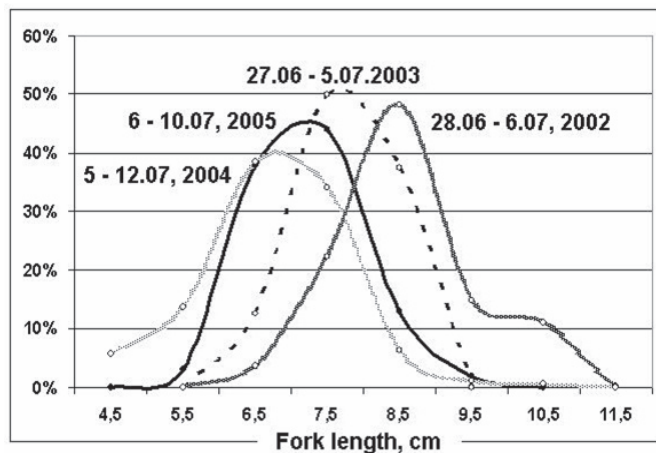
In 2005, research efforts were concentrated in the Aniva Bay. Surveys were repeated three times. During the first lag (6–10 July), pink salmon catches varied from five to 2,867 and averaged 278 fish per haul. Juvenile pink salmon were mostly captured in the western Aniva Bay, above 34–36 m depths (Fig. 1). Chum salmon catches at five stations above the 30 m isobaths and deeper ranged from one to 133 fish per haul. In total, 3,700 juvenile salmon were captured. Frequency of occurrence in trawl catches was 56% for pink salmon and 16% for chum salmon. During the second lag (20–25 July), seven pink salmon juveniles were caught in the eastern Aniva Bay and 151 juveniles in the La Perouse Strait above 51–100 m depths. A single juvenile chum salmon was caught. During the third lag (11–18 August), juvenile salmon were not found in the survey area.

Pink salmon body lengths differed little between the stations of first survey lag, averaging 7.3 cm, and weighing an averaged of 2.94 g. The range of sizes indicated that investigated juveniles originated from the Aniva Bay rivers. Year-to-year comparisons revealed that the variability of pink salmon size indices was in a relatively narrow

Fig. 1. Pink salmon catch distribution in the Aniva Bay and the La Perouse Strait during the first (6–10 July, A) and second (20–25 July, B) lags of pelagic trawl survey.



**Fig. 2.** Length distribution of pink salmon captured during the pelagic trawl surveys in 2002–2005. Dates of survey lags are indicated near the corresponding curves.



During first stage, total numbers of pink salmon juveniles were estimated at 51.6 million fish, with a distribution density of 16,353 fish/km<sup>2</sup>. The total numbers of pink salmon brood from the Aniva Bay rivers were estimated during downstream migration at 219.3 millions in 2005. According to calculations, pink salmon mortality totaled about 76.5% of abundance during 1.5 months in the sea. This estimate may be too large because of the underestimation of juvenile pink salmon numbers in the Aniva Bay. Pink salmon mortality was estimated at 66.6–69.5% within approximately three months from marine environment entering to the autumnal survey in the offshore Okhotsk Sea in the 1990s (Radchenko 2001).

Pink salmon juveniles spend from 2.5 to 0.8 months in the narrow coastal zone out to the 30 m depth from April to early July, depending on the date they enter the marine environment. Their offshore migration did not occur gradually, in proportion to the growth of fishes, but simultaneously during several days. They all leave inshore waters independently from body size but related to the time of downstream migration. Juvenile pink salmon migration offshore coincided with a SST increase up to 14–15°C and with maturing pink salmon migration from the ocean.

Bycatch of pelagic fishes demonstrated significant variability during the survey. Thirty-one fish species from 19 families were captured in the trawl in the upper pelagic layer in Aniva Bay from 6 July to 18 August, 2005. Our survey identified changes in the specific composition and spatial distribution of the fish community. It demonstrated that juvenile pink salmon dwell in a very variable biological surrounding. The biological seasons changed more frequently in Aniva Bay than seasons identified by a calendar.

The tasks of future studies should be: the determination of an optimum timetable for a survey on the basis of the seasonal state of shelf fish community, estimation of the size and biological condition of juvenile salmon, pathways of migration for odd- and even years broodlines, gear improvement, and a quantitative examination of total number and productivity of broodlines.

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