

Trophic Position of Pacific Salmon Juveniles in the Western Bering Sea Epipelagic Communities during Autumn

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The major purpose of our study was the determination of the trophic structure of juvenile Pacific salmon in the epipelagic layer of the western Bering Sea during autumn.

2002–2004 data were collected on research vessels of TINRO-Centre. A total of 234 plankton and 255 trawl stations were made in the epipelagic zone (0–50 m), with stomachs from 11,078 fish taken for diet analyses. Standard methods, widely used in TINRO-Centre studies (Chuchukalo and Volkov 1986), were used for the analyses of fish stomach contents. We identified prey items, total prey weight and weight of each prey component from size categories of fish. Plankton was collected by Juday Net in the epipelagic layer (0–50 m) during day time and night time. All data were averaged for the regions: Commander Basin, western Aleutian Basin, Navarin regions, Karaginskyi, Olutorskiy and Anadyr Bays.

Fig. 1. Diet (%) of pacific pink, chum, sockeye juveniles in the western Bering Sea in autumn 2002–2004.

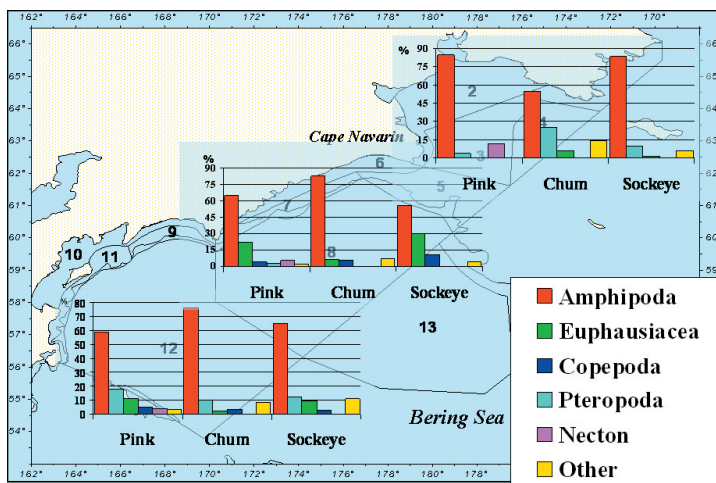
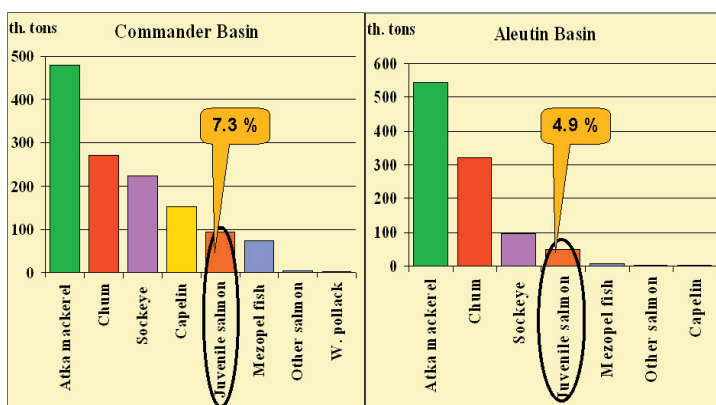


Fig. 2. Consumption of food by pacific salmon juveniles and by masses fish in the epipelagic layer (0–50 m) of the Commander and western Aleutian Basins in autumn 2004.



Juvenile Pacific salmon, originated from the Karaginskyi, Olutorskiy-Navarin and Anadyr areas migrate from shallow bays to the deep waters of the western Bering Sea to forage in these areas in autumn (Shuntov 1989, 1994). According to the database collected in the 2002–2004 trawl surveys, the autumn biomass of juvenile salmon ranged from 26.8 to 33.6 thousand tons (Temnykh et al. 2004; Temnykh 2005), accounting for no more than 1–3% of the total assessed biomass of the common fish species in the entire upper epipelagic western Bering Sea. Pink salmon dominated in numbers and biomass of all juveniles of Pacific salmon species.

During the transition from shallow to oceanic areas in September–November, juvenile salmon actively forage in the epipelagic waters of the western Bering Sea. The highest daily rations were observed for juvenile pink salmon (7.5–7.9% of body weight) and juvenile chum (7.0–7.9%). Daily rations of sockeye, chinook and coho salmon were lower (Efimkin 2003; Efimkin et al. 2004; Chuchukalo and Kuznetsova in press).

We estimated the seasonal weight of food consumed by juvenile salmon in the upper epipelagic layer of the western Bering Sea. Juvenile salmon utilized from 112–154 thousand tons of different zooplankton and nekton forage animals during autumn, while the major fish species consumed 6.4–8.9 million tons of forage animals.

Juvenile pink, chum and sockeye salmon preyed mainly upon the zooplankton. Amphipods, euphausiids and pteropods dominated in the diet of pink, chum and sockeye salmon (Fig. 1). Copepods, nektonic organisms and meroplankton were of much less importance as prey items. In the Gulf of Anadyr and Commander Basin, pteropods accounted for 10–18% of total prey weight and was much higher than in the western Aleutian Basin, where they accounted for less than 2.5% of food. The share of euphausiids in the juvenile salmon diet was higher in the western Aleutian Basin, where these crustaceans accounted for 22.3–30.1% of the pink and sockeye salmon diet, and 5.9% of the chum salmon diet. In the Commander region, euphausiids accounted for only 10.7–9.4% of all food consumed by pink and sockeye salmon and 2.5% of the chum salmon prey. Chinook and coho salmon preyed predominantly upon nektonic animals. This prey preference was associated with morpho-physiological features of these two salmon species. The plankton species, which accounted at most for 25.2–31.3% of food consumed by juvenile chinook salmon, were represented mainly by large crab larvae and rarely by large mature euphausiids (*Thysanoessa longipes*). There was a high proportion of euphausiids in the diet of juvenile salmon in the western Aleutian Basin. Pteropods and amphipods in the Commander Basin were associated with dense aggregations of these planktonic groups in a local plankton community.

Of all the prey species, salmon consumed mainly *Themisto pacifica* among amphipods and *T. longipes* among euphausiids. These two plankton species were also heavily preyed on by juvenile walleye pollock (*Theragra chalcogramma*), as well as by immature sockeye and chum salmon, atka mackerel juveniles, and by other fish. During our surveys there was a large biomass of juvenile walleye pollock in the northwestern Bering Sea (Shuntov et al. 2000; Starovoitov et al. 2004). The major forage areas for juvenile salmon were Olutorskyi-Karaginskyi region continental slope, Commander and western Aleutian Basins.

The overall amount of food consumed by fishes in the upper epipelagic layer in the Commander Basin totaled 1.3 million tons and in western Aleutian Basin, 1.0 million tons. Juvenile salmon consumed 7.3% of the total amount of all food consumed by all fish in the Commander Basin, and 4.9% in the western Aleutian Basin (Fig. 2). Thus, the role of juvenile salmon in the trophic structure of the epipelagic layer in the waters of the Commander and Aleutian Basins, as well as the nearby Olutorsky-Karaginsky shelf break areas, was more important than in the northwestern Bering Sea.

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