Feeding Habits of Chum Salmon *Oncorhynchus keta* in the Central Bering Sea during Summer, 2002

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From the late 1970s to 1990s, the abundance of chum salmon in the North Pacific Ocean and Bering Sea increased steady, while the body sizes of returning fish decreased (Ishida et al. 1993, 2002). During the summer growth period, a substantial number of chum salmon and other species of Pacific salmon congregate in the Bering Sea to feed; therefore, density-dependent growth control is likely. To clarify the mechanisms of growth control, information on the pattern of food resource use is essential. Here, we describe ontogenetic, seasonal, and diel variations in food habits of chum salmon in the Bering Sea.

In 2002, we collected chum salmon during surveys by the RV *Kaiyo maru* from June 29 to July 15 (Leg 1; 24 trawl stations) and from August 16 to September 18 (Leg 2; 38 trawl stations) in the central Bering Sea. Fishing gear used was a surface trawl net with a mouth of ca. 50 x 50 m. Stomachs were collected from a maximum of 20–30 individuals at each station. The contents of each stomach were sorted to the lowest possible taxonomic groups, and the digestive stages and dry weight composition (*DWC*) were determined. *DWC* was compared among salmon size classes, legs, and time periods (morning and afternoon). To examine the oceanographic conditions, sea surface water temperature (SST) was measured at each sampling station; the zooplankton abundance in the surface layer was measured by an Electronic Particle Counting and sizing System (EPCS).

The abundance of chum salmon in the central Bering Sea doubled as SST increased from Leg 1 to Leg 2, while mean zooplankton abundance decreased by half (Fig. 1). The diets of chum salmon differed consistently between legs, and varied widely within each leg (Fig. 2). During Leg 1, the most important prey for all size classes of fish was zooplankton, mainly euphausiids. Gastropods, hyperiid amphipods, and copepods occurred frequently in salmon diets, although they represented relatively small fractions in *DWC*. During Leg 2, the dominant prey of chum salmon shifted from zooplankton to fish such as myctophids, walleye pollock, and Atka mackerel. The decrease of zooplankton in the diet of chum salmon from Leg 1 to Leg 2 reflects the seasonal reduction of zooplankton abundance in the study area. There was little ontogenetic dietary difference in the diets of chum salmon. All of the different age groups of chum salmon preyed on

Fig. 1. Changes in oceanographic conditions between Leg 1 (June 29–July 15) and Leg 2 (August 16–September 18) of the RV *Kaiyo maru* survey in the central Bering Sea in 2002; a) mean SST of the sampling stations, b) zooplankton density measured by EPCS, c) chum salmon density estimated by trawl survey.

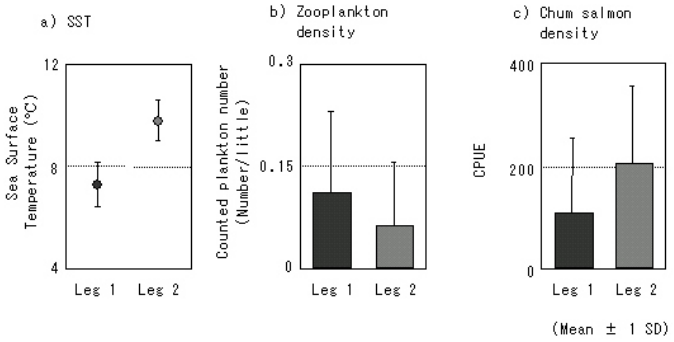
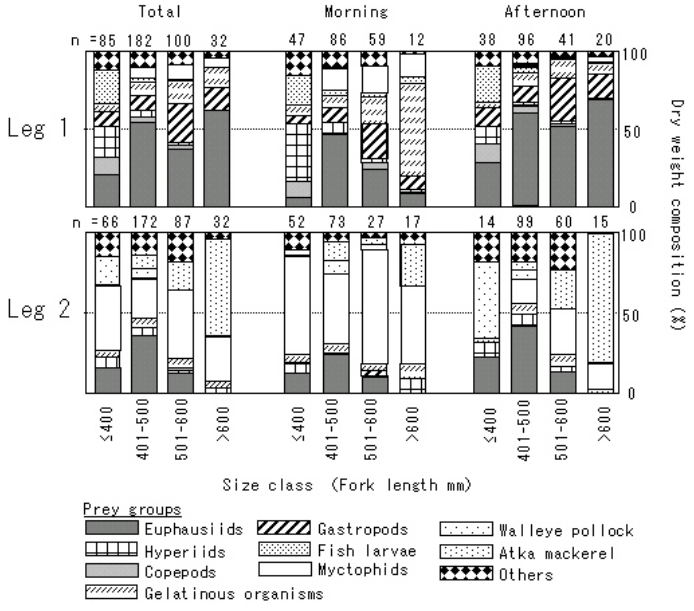


Fig. 2. Diet of chum salmon expressed as prey dry weight composition for different fish size classes, cruise legs (Leg 1, June 29–July 15; Leg 2, August 16–September 18), and time of day.



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euphausiids and myctophids, namely *Thysanoessa longipes* and *Stenobrachius leucopsarus*. *S. leucopsarus* was frequently ingested by the fish caught in the morning, and these stomach contents would reflect nighttime feeding. *S. leucopsarus* undertakes a diurnal vertical migration (DVM), whereas chum salmon persists above the thermocline (Ogura and Ishida 1995). Thus, the diurnal difference in chum salmon diets would reflect change in the vertical distribution of its prey. Furthermore, the average nighttime length changed remarkably in the Bering Sea between legs from 7 h (Leg 1) to 12 h (Leg 2). This seasonal lengthening would increase the probability of encounters with *S. leucopsarus* in the epipelagic zone, and then result in the increased ingestion by chum salmon observed during Leg 2. Chum salmon thus changed their main prey both seasonally and diurnally depending on the availability of prey. This flexibility seems to enable them to prosper in the subarctic Pacific Ocean.

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