ESTUARINE ECOLOGY OF SOCKEYE SALMON
IN BRISTOL BAY

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and

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Estuarine Ecology of Sockeye Salmon in Bristol Bay

Investigations of the estuarine and early marine life of the Bristol Bay sockeye salmon were initiated in 1965 by the Bureau of Commercial Fisheries Biological Laboratory, Auke Bay, Alaska. These studies were designed to determine the relationships of distribution, behavior, and growth of the sockeye while in Bristol Bay to the physicochemical processes operating in the bay.

Exploratory fishing for seaward migrating sockeye salmon and hydrographic studies were carried out in upper Bristol Bay in 1966 and 1967 and extended to outer Bristol Bay as far as Unimak Pass in 1969. The results of these studies will provide the fundamental knowledge necessary for planning future investigations of the causes, extent and annual variability of mortality of young sockeye in Bristol Bay during seaward migration. This information, in turn, will be utilized in conjunction with smolt outmigration estimates to improve the accuracy of forecasts of returning runs of sockeye salmon to Bristol Bay. Some results have been reported in graduate theses by Carlson (1968), Jaenicke (1968), and Straty (1969).
A series of stations were fished along transects across the bay in 1966 and 1969. In 1967 fishing was carried out primarily in the Port Moller area. Fish were captured with a tow net and round haul seine (1966), a lampara seine (1967), and purse seine (1969). Figures 1 - 3 show the stations fished and the location of capture of young sockeye. Seaward migrating sockeye salmon were caught at most stations across upper Bristol Bay, i.e., toward the head of the bay from Port Heiden. They were most abundant, however, on the southeast side of the upper bay and further seaward in coastal waters along the north side of the Alaska Peninsula. Few fish were caught on the north side of the bay or further offshore than 35 miles on the southeast side of the outer bay. The primary seaward migration route of Bristol Bay sockeye is on the southeast side of Bristol Bay at least as far seaward as 163° West longitude.

To determine if all major stocks of sockeye salmon follow the same seaward migration route, fish were marked as smolt on several major Bristol Bay river systems in 1967 and 1969. These fish were sprayed with colored fluorescent grit, a different color for each river. Marked fish were captured at various locations in the bay one to three months after marking (Figure 4). The distribution of recoveries shows that the major river stocks of Bristol Bay sockeye salmon move to and proceed seaward on the southeast side of Bristol Bay.
The seaward movement for all river stocks of sockeye is against the net or non-tidal current (which is toward the head of the bay on the southeast side), through the region having the steepest salinity gradient and into that portion of the bay having the highest salinity. Preliminary examination of zooplankton hauls made during exploratory fishing operations in Bristol Bay suggest this region is the most productive in terms of food organisms for the young sockeye.

The outmigration of sockeye salmon smolt from most river systems in Bristol Bay is essentially completed by late June. Examination of the growth pattern on the scales of seaward migrating sockeye captured during their first month in Bristol Bay showed that most fish had put on very little growth. The scales of fish captured in late July and early August showed the beginning of rapid marine growth. This apparent delay in the commencement of rapid growth by sockeye smolt soon after entering Bristol Bay may possibly be due to: (1) the time required to acclimatize to marine life, or (2) low food abundance in the upper bay at the time of outmigration.

The results of the 1969 exploratory fishing indicated that the majority of the sockeye smolts from Bristol Bay rivers were not further seaward than 163°West longitude by late August.
References:

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Food habits of juvenile sockeye salmon in the coastal waters of Bristol Bay, Alaska.  

Jaenicke, H. W.  
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M.S. Thesis, Humboldt State College.

Straty, R. R.  
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The migratory pattern of adult sockeye salmon (Oncorhynchus nerka) in Bristol Bay as related to the distribution of their home river waters.  
Figure 1. -- Stations fished and location of capture of seaward migrating sockeye salmon, June - September 1966
Figure 2. --Stations fished and location of capture of seaward migrating sockeye salmon, June - August 1967
Figure 3. --Stations fished and relative abundance (catch per unit of effort) of seaward migrating sockeye salmon in Bristol Bay, June - August 1969
Figure 4. --Distribution of marked seaward migrating sockeye salmon captured in Bristol Bay, 1967 and 1969