Benefits of Living Life on the Edge: Enhanced Growth and Foraging Opportunities for Juvenile Salmon Inhabiting the Margins of the Sitka Eddy

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Salmon stocks from Alaska, British Columbia, and the Pacific Northwest use the Gulf of Alaska (GOA) as a migratory corridor, which creates potential for inter- and intra-specific competition during periods of high density or spatial overlap. Mesoscale, anticyclonic eddies propagate westward through the Gulf of Alaska from their formation regions along the eastern and northern continental margins (Crawford and Whitney 1999). Most eddies form in late winter and early spring; almost all rotate anticyclonically with typical diameters of 100 to 300 km (Crawford 2002). Juvenile pink (*Oncorhynchus gorbuscha*), chum (*O. keta*), and sockeye (*O. nerka*) salmon migrating through the coastal GOA during 2010 were distributed throughout the Sitka eddy during the month of July. This study is a basic investigation into how these often large, prominent, and dynamic oceanographic features may influence the health and ultimately the survival of salmon during early ocean residence.

Field sampling efforts began in the coastal waters north of the Southeast Alaska Archipelago in early July and moved south terminating in at the southern tip of Baranof Island in late July. Juvenile salmon were collected with a 184-m long Nordic 264 rope trawl that was fished at the water surface (Orsi et al. 2011) aboard a 49-m chartered fishing vessel. The Nordic 264 rope trawl is comprised of hexagonal mesh wings with a 1.2-cm mesh codend liner and a mouth opening of 24 m deep by 20 m wide (Sturdevant et al. 2011). Insulin-like growth factor 1 (IGF1) was measured from blood collected from juvenile chum, pink, and sockeye salmon in order to provide an index of short-term growth rate for fish at each survey station. Plankton and chlorophyll samples were also collected aboard the vessel at each survey station. Short-term growth rate, energetic condition, and prey quality of juvenile pink, chum, and sockeye salmon were contrasted with geographic position of fish within the eddy as measured by sea surface height.

Fish caught at locations along the eddy perimeter displayed the highest levels of insulin-like growth factor (Fig. 1),

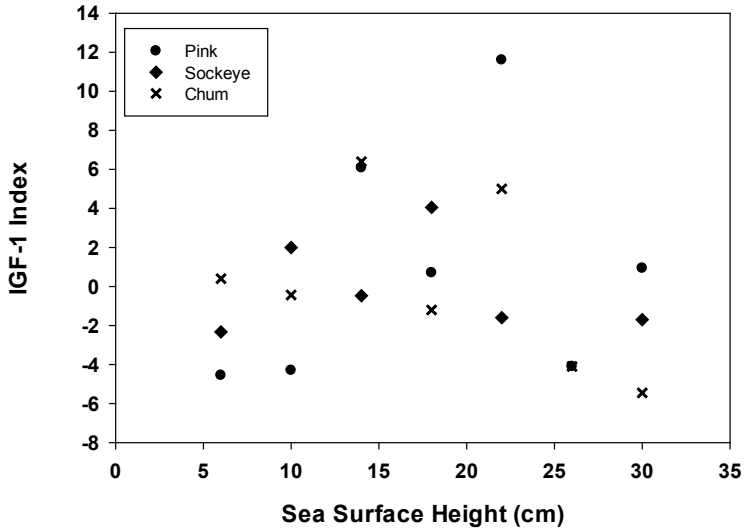

Fig. 1. IGF-1 (insulin like growth factor-1) index values of pink, sockeye, and chum salmon plotted against the location of fish within the Sitka eddy as measured by sea surface height (cm).

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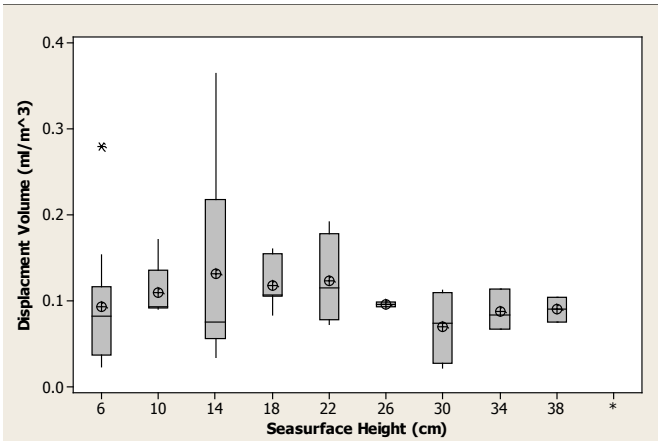

Fig. 2. Zooplankton displacement volume (ml/m^3) plotted against the location of samples within the Sitka eddy as measured by sea surface height (cm).

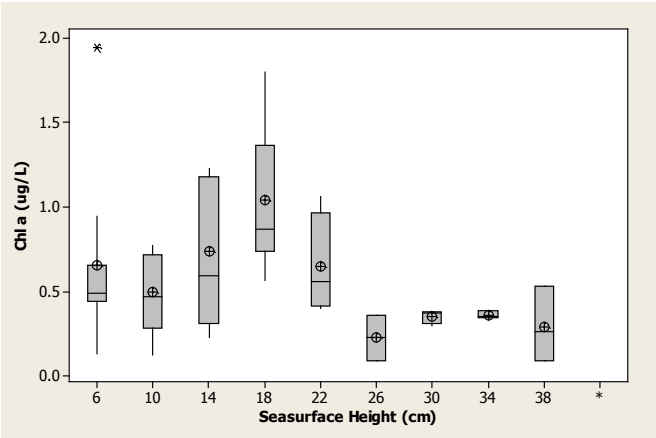

Fig. 3. Chlorophyll-*a* concentration (µg/L) plotted against the location of samples within the Sitka eddy as measured by sea surface height (cm).

indicating that juvenile salmon located in this ocean habitat experienced elevated short-term growth rates. Zooplankton and phytoplankton density was also greatest around the eddy perimeter (Figs. 2 and 3). The position, timing, and strength of the Sitka eddy combined with juvenile salmon outmigration timing may positively affect growth through increased foraging opportunities. Years in which the three primary eddy features in the eastern GOA (Haida, Sitka, and Yakutat eddies) are located close to shore during early summer months, when juvenile salmon are migrating north, enhanced production along the eddy perimeters and should lessen inter- and intra-specific competition and could result in increased survival for certain stocks.

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