

## Northeast Pacific juvenile salmon summer surveys in 2018

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PICES has a long history of sponsoring integrated North Pacific marine research linking climate and ocean conditions to fish population dynamics (Beamish, 1995; Hollowed *et al.*, 2011; Alheit *et al.* In press). Pacific salmon (*Oncorhynchus* spp.) are a culturally and economically important species in the North Pacific, and their status upon returning to freshwater serves as a useful integrator of ocean conditions over the past few years. Several basin-scale and regional indices, including ecological indices, have been linked to the marine survival of Pacific salmon at the juvenile stage (Mantua *et al.*, 1997; Wells *et al.*, 2008; Burke *et al.*, 2013). Pacific Decadal Oscillation and North Pacific Gyre Oscillation patterns correspond to coastal temperature spatial variability, with cascading impacts on lower trophic level community structure, such as zooplankton composition and abundance (Peterson *et al.*, 2014), and coherency to broad-scale patterns in Pacific salmon marine survival (Malick *et al.*, 2017). Recent heat wave anomalies in the eastern North Pacific and the concomitant ecological changes may therefore have impacts on Pacific salmon (Morgan *et al.* In Press). Ecosystem dynamics impact the first marine summer growth, migration, and overall survival of juvenile salmon (Burke *et al.*, 2016; Burke *et al.*, 2013; Freshwater *et al.*, 2018; Moss *et al.*, 2005). To better understand these ecological dynamics, summer coastal surveys for juvenile salmon are conducted by federal agencies from Canada (Fisheries and Oceans Canada) and the United States (National Marine Fisheries Service). These important surveys provide relevant data on ocean conditions and an early indication of Pacific salmon marine survival, and ultimately inform ecosystem models that support management decisions.

Pacific salmon in the eastern Pacific enter the ocean from several main watersheds, most notably the Columbia River between Oregon and Washington, the Puget Sound and Fraser River basins of the Salish Sea, the Nass and Skeena Rivers in northern British Columbia, and the Kenai and Yukon Rivers in Alaska. Juvenile salmon migrate northwards along the coast towards overwintering grounds in the central Gulf of Alaska. Coastal juvenile salmon surveys are composed of mixed stocks originating from several of these large watersheds. Although variability among stocks or populations exists, collating information from juvenile salmon surveys conducted along the North American coast from Oregon and Washington to the Bering Sea (Fig. 1) provides an indication of broad-scale patterns in salmon marine survival throughout their migratory corridor. By studying these large-scale dynamics, we may be able to better identify the mechanistic drivers of marine growth and survival of these iconic fish.



Fig. 1 Summer juvenile salmon surveys are conducted throughout the northeast Pacific and into the Bering Sea by Canada (Fisheries and Oceans Canada) and the USA (National Marine Fisheries Service); general survey areas denoted by polygons. Here we report on the most recent observations off Oregon–Washington (June 19–28, 2018; OR-WA dark green); off the west coast of Vancouver Island (July 5–29, 2018; WCVI dark orange); from Puget Sound (monthly from April–October 2018; PS yellow); from Strait of Georgia (June 17–July 4, 2018; SOG light orange); coastal waters in southeast Alaska (June 18–25, July 26–31, and August 20–25, 2018; SEAK light green); the Gulf of Alaska (July 7–August 16, 2017; GOA pink); southeastern Bering Sea (September 20–October 4, 2018; BS blue); and northern Bering Sea (August 27–September 19, 2018; NBS teal).

### Survey time-series

Time-series on relative abundance of juvenile salmon are available from eight long-term surveys conducted in the coastal waters of Oregon–Washington (OR-WA), the west coast of Vancouver Island (WCVI), Skagit Bay in Puget Sound (PS), the inland waters of the Strait of Georgia