COMPREHENSIVE LIST OF HYPOTHESES, STRAIT OF GEORGIA (SOG) AND PUGET SOUND (PS). ASSESSMENT STATUS COLOR CODE = UNDERWAY, PLANNED, CONCEPT.

Name	Explanation	Prediction	Assessment Status	
			SOG	PS
Marine vs freshwater survival	Marine survival does a better job than freshwater survival in explaining productivity trends of Chinook, coho and steelhead in the Salish Sea.	Marine survival better explains long-term productivity trends, since 1980s; however, among years, populations and basins may have greater variation between fresh vs marine.	√	√
Factors operate at different levels	Ecosystem and community factors affect salmon and steelhead survival at different levels by area encountered, species, hatchery v. wild, and within species, by life-history.	Multiple species and spatial and temporal scales must be assessed to isolate primary factors that explain current vs long-term survival trends.	√	√
Critical period	Chinook and coho marine survival is thought to be set during critical periods/windows.	Total marine survival is correlated to early marine survival.	√	√
		Total marine survival is correlated to winter survival.	√	
Critical size / Smolt condition	Size-Selective mortality is an important process regulating survival at one or more life stages of Chinook and coho.	Larger body size at certain life stages, from lower river through early marine, confers higher survival to adulthood.	√	√
	Conditions in the freshwater environment affect the ability of the smolt to survive in the marine environment (additional emphasis).	Larger and fatter smolts have higher survival.	√	√
		Physiologically prepared smolts have higher survival.	√	
		Hatchery fish have lower marine survival than wild fish.	√	√
Critical growth	Growth rates regulate survival at one or more life stages of Chinook and coho.	Faster growth rates at certain life stages, from lower river through early marine, confers higher survival to adulthood.	√	√
Outmigration timing	Outmigration timing of Chinook, coho and steelhead influences the magnitude effect of competition, predation, buffering, and environmental variation on survival in the Salish Sea.	Timing of certain stocks of Chinook, coho and steelhead combined with specific environmental factors correlates with higher mortality/lower marine survival.	√	√

Name	Explanation	Prediction	Assessment Status	
			SOG	PS
Residency	Resident-type behavior and the duration of residence influence survival in the Salish Sea.	Increased residency correlates with higher overall marine survival of Chinook and coho. Likely associated with increased food availability and/or less predation.		√
Portfolio effect	Through a process known as the portfolio effect, diversity among salmonid populations confers temporal stability and long-term persistence of the species within the Salish Sea.	Populations with more genetic and/or life-history diversity have higher marine survival compared to those that don't.		√
Prey availability: Food supply	There is an insufficient food supply to meet demand by Chinook, coho and steelhead.	Timing, duration, quantity, spatial extent, and/or composition/quality of prey influences food consumption rates and growth.	√	√
Prey availability: Productivity	Fish that grow quickly during critical growth periods survive better because they can escape predators, outcompete competitors, or survive winter better.	Food consumption rates and growth increase with prey production.	√	√
		Marine survival increases with prey production.	√	√
Prey availability: Match-mismatch	There is a mismatch between demand (outmigrant timing and condition) and food supply.	Smolts that enter during optimum food supply conditions perform better. Smolts that don't survive worse.	√	√
Prey availability: Prey quality	Growth of juvenile salmon is affected by the nutritional content of their food.	Marine survival and growth increases with the availability of fat/nutritious prey.	√	√
Metabolic effects	Growth is limited by the metabolic effects of temperature on juvenile salmon	Growth decreases when outside a peak temperature window for metabolism.		√
Density dependence and Competition	Prey availability is reduced when competition for food increases during critical periods	Marine survival decreases with increasing smolt abundance. [e.g., changes in pink abundance between odd-even years].	√	√
		Growth and food consumption rates are inversely related to the abundance of competitors.	√	√
Winter starvation	Winter is a critical period due to low food availability and low temperatures.	Fish that do not reach a critical size, growth, or lipid concentration prior to the winter will not survive.	√	
Predation: Intensity	Predation is a direct/proximate (and potentially underlying/ultimate) cause of mortality.	Mortality rates increases with the abundance of predators.	√	√

Name	Explanation	Prediction	Assessment Status	
			SOG	PS
		Mortality rates increase with increased harbor seal prey specialization targeting Chinook, coho, or steelhead.		√
		Mortality rates increase with reduced turbidity.		√
Predation: Pulse prey abundance	Predator behavior increases with large pulses juvenile salmon and/or steelhead entering the marine environment.	Mortality rates increase immediately following influxes of juvenile salmon and/or steelhead in the marine environment.		√
Predation: Buffering capacity	The probability of being detected by predators decreases with the abundance of alternative prey.	Mortality rates decreases with increasing abundance of forage fish [or other prey items such as euphausiids].	√	√
Disease - Predation	Infected fish may be more susceptible to predators or simply die from the infection.	Mortality increases with increasing parasite or pathogen loads.	√	√
		Disease leads to reduce swimming performance and increased predation.	√	√
Cont-aminants	Exposure to contaminants in freshwater habitats causes latent reductions in marine survival of juvenile salmon.	Chinook, coho and steelhead populations that obtain higher contaminant loads, above thresholds affecting health, during in river rearing have lower marine survival.		√
	Exposure to contaminants in estuarine and marine waters reduces the marine survival of juvenile salmon migrating through the Puget Sound to the Pacific Ocean.	Chinook, coho and steelhead populations that obtain higher contaminant loads, above thresholds affecting health, during outmigration have lower marine survival.		√
	Exposure to contaminants in estuarine and marine waters of Salish Sea reduces the marine survival of salmon residing in the Salish Sea.	Chinook and coho populations that obtain higher contaminant loads, above thresholds affecting health, during outmigration and Salish Sea marine residence have lower marine survival.		√
Water quality - Prey availability	Changes in circulation and water properties have altered phytoplankton and zooplankton production in ways that degraded salmon food-webs in the Salish Sea.	The timing, duration, quantity, spatial extent, and/or composition/quality of salmon prey is constrained by a different state of circulation, water properties, and boundary forces (wind, temp, open ocean conditions, river inputs) in the 2000s vs the 1970s.		√
Ocean acidification	Ocean acidification affects the productivity or nutrition quality of important zooplankton invertebrate prey for salmon (and forage fish).	The timing, duration, quantity, spatial extent, and/or composition/quality of zooplankton are constrained as the Salish Sea becomes more acidic.		√

Name	Explanation	Prediction	Assessment Status	
			SOG	PS
	Increased CO2 concentrations affect the nervous system and behavior of salmon and steelhead or affect growth.	Chinook, coho and steelhead mortality rates increase with increasing CO2 concentrations in the Salish Sea marine environment.		√
	Elevated CO2 concentrations alone and combined with increased temperatures are promoting *Heterosigma* growth, which can affect salmon survival.	Elevated CO2 concentrations and temperature have increased the prevalence and intensity of Heterosigma blooms.		√
	Synergistic responses to elevated CO2/low pH concentrations combined with low oxygen, warming, and eutrophication can occur, as well as the combined effects of ocean acidification and toxics.	Models of elevated CO2/low pH concentrations combined with lower oxygen, higher temperatures, increased nutrients, and contaminant inputs show a synergistic environmental response harmful to the salmon and/or their prey.		√
Harmful algae	Harmful algae directly affect salmon survival through acute or chronic toxicity or gill damage.	Direct mortality increases as prevalence and intensity of *Heterosigma* and other harmful algae increase.	√	√
	Harmful algae indirectly affect salmon survival through food web and salmon prey impoverishment.	The timing, duration, quantity, spatial extent, and/or composition/quality of zooplankton are constrained by competition between primary producers of high and low (i.e. harmful algae) nutritional value .		√
Reduced habitat	Reduced habitat availability and/or diversity have affected the behavior (and reduced the diversity) of salmon while in the Salish Sea.	Reductions of estuary, eel grass, and/or kelp habitat in specific sub-basins correlates with lower marine survival.	√	√