Northeast Pacific Pink & Chum Salmon Workshop 25th 2012 Juneau, Alaska

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Salmon as predators and prey in marine waters of Alaska

Science, Service, Stewardship

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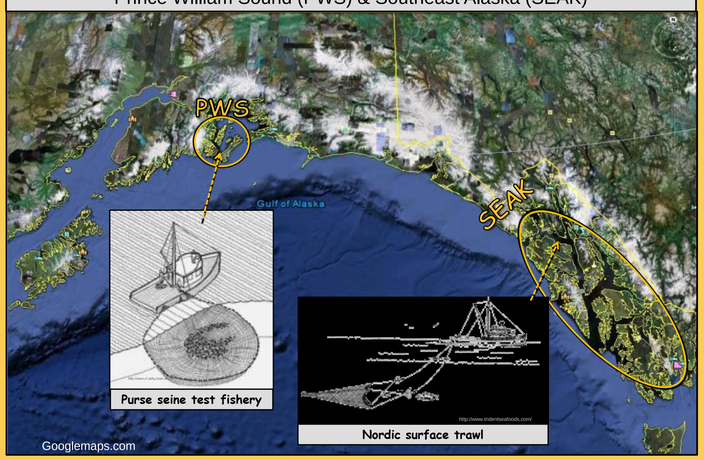
Abstract--Predation during the early marine critical period is thought to determine year class strength for juvenile Pacific salmon, but predation impact is hard to document because it requires consistent sampling over extended periods to capture infrequent or episodic events. Juvenile salmon are among the most abundant daytime forage species available in summer to epipelagic predators in marine waters of Southeast Alaska (SEAK), and returning adult salmon are among the most abundant potential fish predators. Because of the spatial and temporal overlap of juveniles and adults of the five species, the potential for cannibalistic interactions to influence subsequent returns has long been of interest. To identify levels of predation on juvenile salmon, we examined the 15-year time series (1997-2011) of adult salmon and other potential predators captured in surface trawls by the Southeast Coastal Monitoring (SECM) project in SEAK, and two years of predation by adult pink and chum salmon captured in purse seines near shore in Prince William Sound. Here, we focus on the degree of piscivory and incidence of predation on juvenile salmon by adult/immature Chinook, coho, sockeye, chum, and pink salmon, address the potential for cannibalism by alternate year broodlines of pink salmon to depress returns the following year, and provide an example of the impact of an abundant episodic predator, immature sablefish, on salmon.

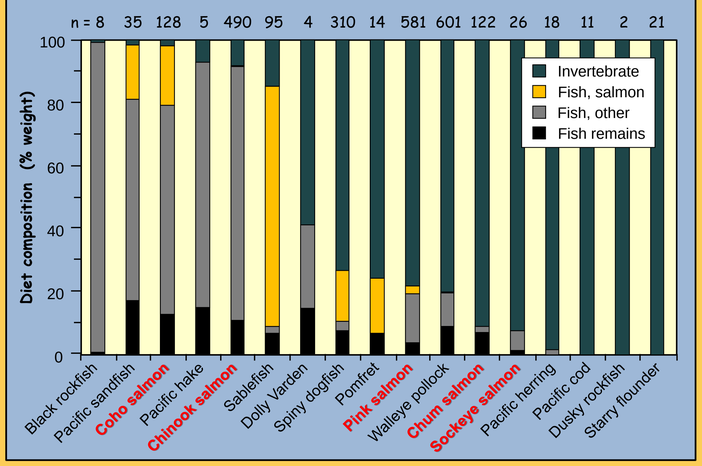
Study area & predation overview

Sampling in migration corridors of Prince William Sound (PWS) & Southeast Alaska (SEAK)



Juvenile & adult salmon overlap in space & time, relative size is appropriate for predation, but abundance & timing of both varies.

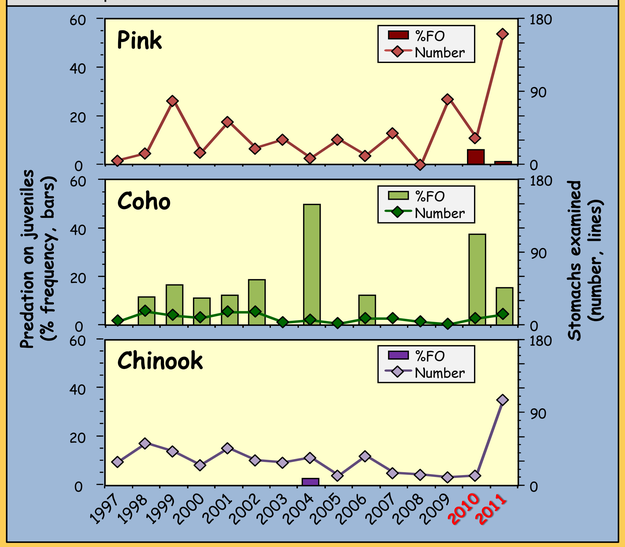
More than half of ~2500 predators examined in SEAK in 15 years were adult/immature salmon (in red). Juvenile salmon occurred in 7 epipelagic fish species' diets, including coho, Chinook, & pink salmon. Immature sablefish had the highest rate of predation, but occurred in strait habitat only one year.



For details: Sturdevant, Orsi, and Fergusson. In review. Nekton prey of epipelagic fish predators in coastal Southeast Alaska, May-September, 1997-2011. Marine & Coastal Fisheries.

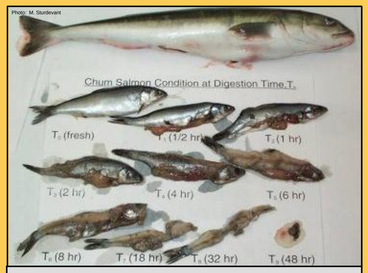
Adult salmon predation in SEAK-epipelagic

In SEAK, adult coho salmon consistently preyed on juvenile salmon. Pink salmon cannibalism was observed only in 2 of 15 years, & only one incident of predation was observed for Chinook salmon.



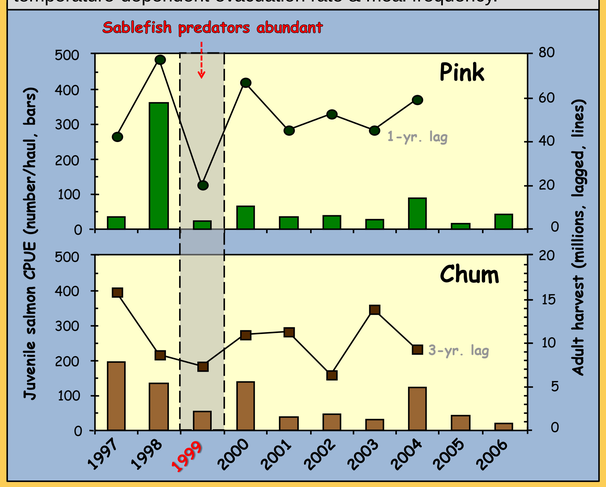
Episodic sablefish predation

More than half of sablefish examined at sea had each eaten 1-4 juvenile chum, pink, or sockeye salmon.



Sablefish digestion rate was twice as fast at 12 C vs. 7 C in the laboratory.

Episodic predation impact by immature sablefish in 1999 was reflected later in low pink & chum harvests. We used field & lab data to estimate 1-6 M juvenile salmon taken in Icy Strait, based on temperature-dependent evacuation rate & meal frequency.



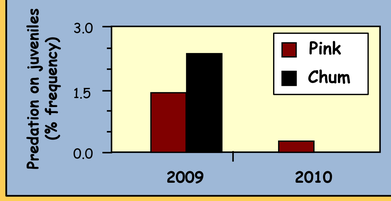
For details: Sturdevant, Sigler, & Orsi. 2009. Sablefish predation on juvenile Pacific salmon in coastal marine waters of Southeast Alaska in 1999. Trans. Am. Fish. Soc. 138: 675-691.

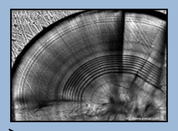
Adult salmon predation in PWS-nearshore

In PWS overall, < 1% of 680 adult pink & chum salmon preyed on juvenile salmon in 2009-10. Otoliths of both predator & prey revealed cannibalistic, interspecific, & hatchery-wild interactions involving salmon from many release locations & origins.

Cannibalism by adult pink salmon varies

More non-feeding pinks in PWS in 2010 vs. 2009





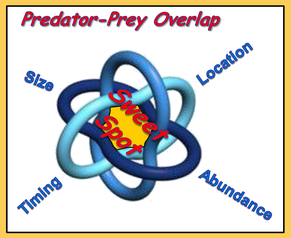
Thermal marks identify hatchery pinks

Adult pink salmon returns to PWS in 2010 were high, despite the higher predation rates on juveniles by lower returning adults in 2009. This evidence does not support the theory that alternate broodline cannibalism on outmigrating juveniles depresses adult returns.

Return year	Harvest (1000's of fish)	Number of predator guts	Empty guts (%)	Predation incidence (%)	Potential 1000's consumed
2008	42,354	0	?	?	?
2009	19,001	214	56	1.4	26.6
2010	71,310	407	79	0.3	17.5
2011	32,750	400	TBD	TBD	TBD

Harvest data from http://www.adfg.alaska.gov/index.cfm?adfg=CommercialByFisherySalmon.exvesselquery

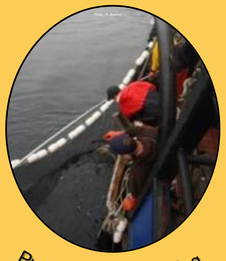
Current research directions



Current predation research is designed to compare pink salmon cannibalism among 3 nearshore regions using 2011 purse seine test fishery samples:

- Southwest PWS
- Central SEAK
- Northern SEAK

This project also permits comparison of predation in epipelagic vs. nearshore habitats in SEAK, & potentially differing hatchery-wild interactions.



Purse seine test fishing

Opportunities for predation vary interannually, as pink salmon cannibalism illustrates. Cannibalism was first observed in SEAK in 2010 when juveniles were very abundant & adults *were not*, & again in 2011 when juveniles were not abundant but adults *were*. Current research considers relationships between climate, juvenile size, timing, & growth, adult return timing, & abundance of competitors & alternate prey to study predation processes.

Typical trawl catch of juvenile salmon

2010 extraordinary trawl catches!

Interannual size of juvenile pink salmon in SEAK in July, with examples of predation