

Hypothesis:
Predation by marine mammals is an
important contributor to the Fraser sockeye
situation

Peter Olesiuk & John Ford
Conservation Biology Section
Marine Ecosystems and Aquaculture Division
Pacific Biological Station

Marine mammals of Pacific Canada

25 Cetaceans, 5 Pinnipeds, 1 Mustelid



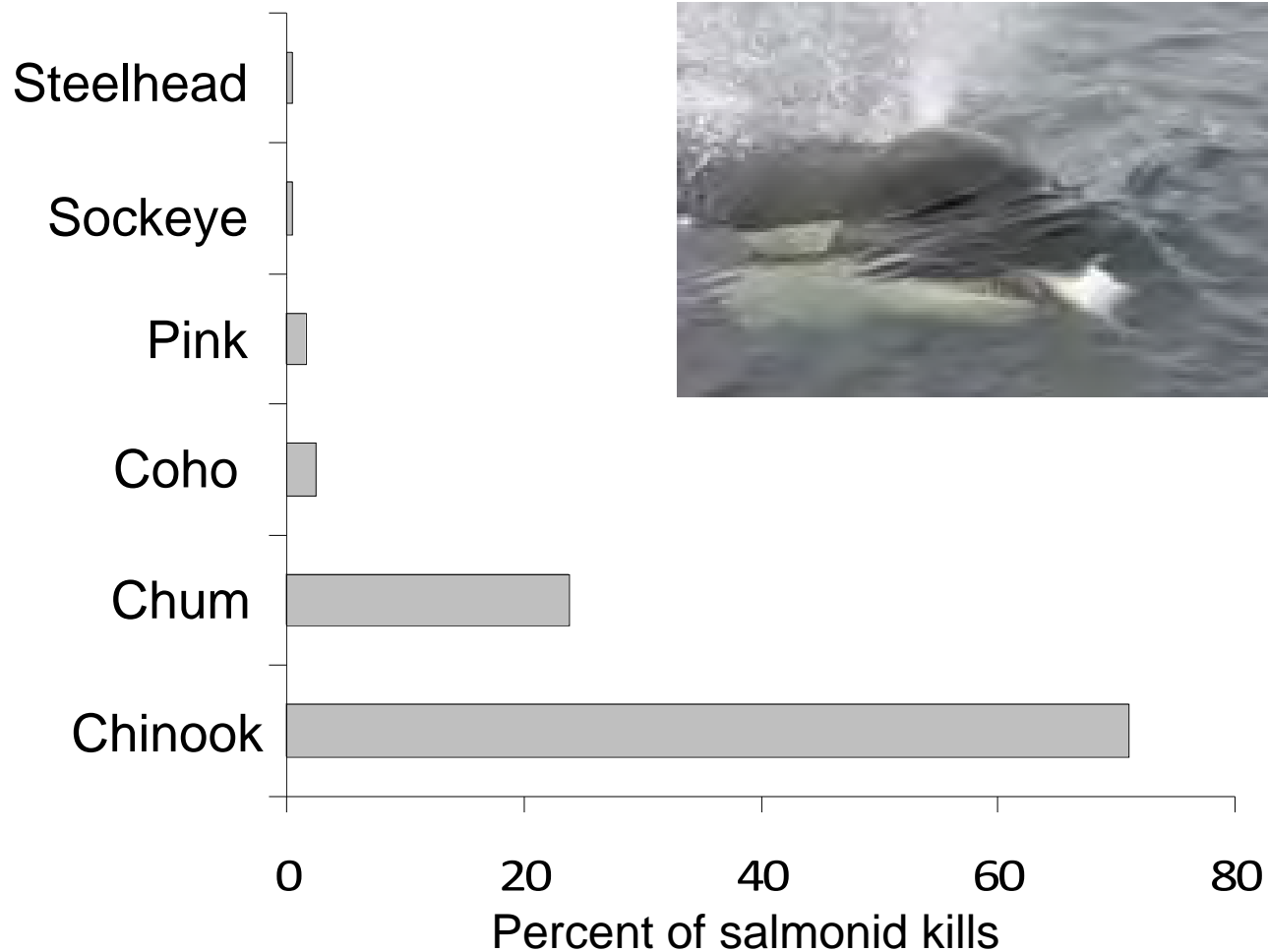
Approach

- Identify known or potential salmonid predators
- Review current status and distribution
- Estimate extent of predation on sockeye, particularly for Fraser River stocks
- Assess population trend to infer whether sockeye predation rates may be increasing or decreasing

Killer whale
Orcinus orca



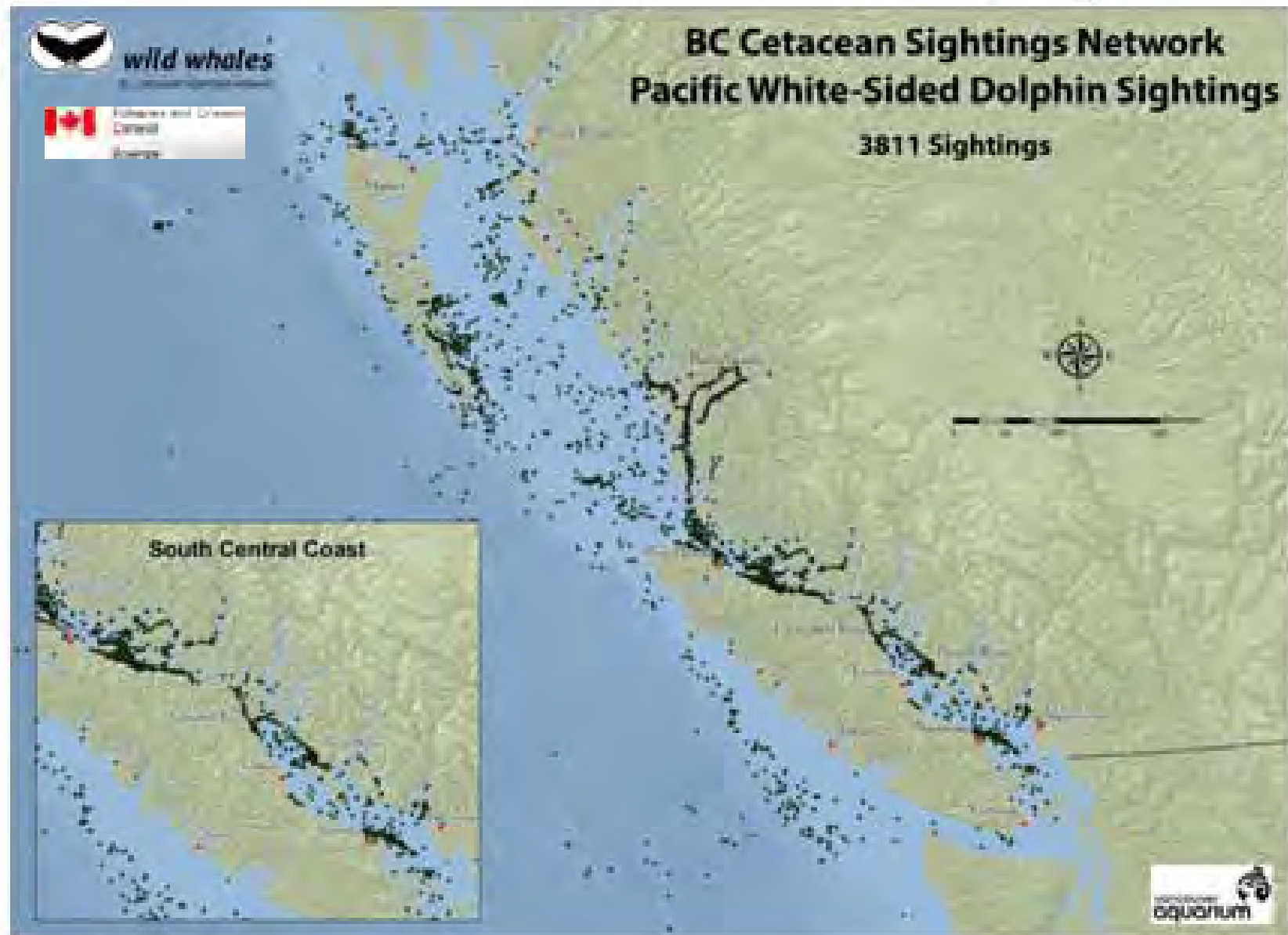
Salmonid species identified from predation events by resident killer whales (n = 806 kills)



Pacific white-sided dolphin
Lagenorhynchus obliquidens



Distribution: Pac. White-sided dolphin



Status: Pacific white-sided dolphin



- North Pacific: 993,000 (CV = 0.90) ???
- Coastal British Columbia: 25,900 (12,900-52,100)
- Largely absent from nearshore waters for 20-30 years prior to mid 1980s
- Abundance increased throughout late 1980s and 1990s, mostly through inshore shift in distribution

Diet: Pacific white-sided dolphin



Diet composition from prey fragment sampling, 1994-95 (n = 63 samples)



Conclusion: Pac. white-sided dolphin



- Opportunistic predator of schooling fish
- Only cetacean in region with potential to consume significant numbers of out-migrating as well as returning adult sockeye
- Further studies needed to define seasonal and geographic variation in diet
- No evidence of substantial change in abundance or distribution over past decade
- Role in sockeye decline unknown

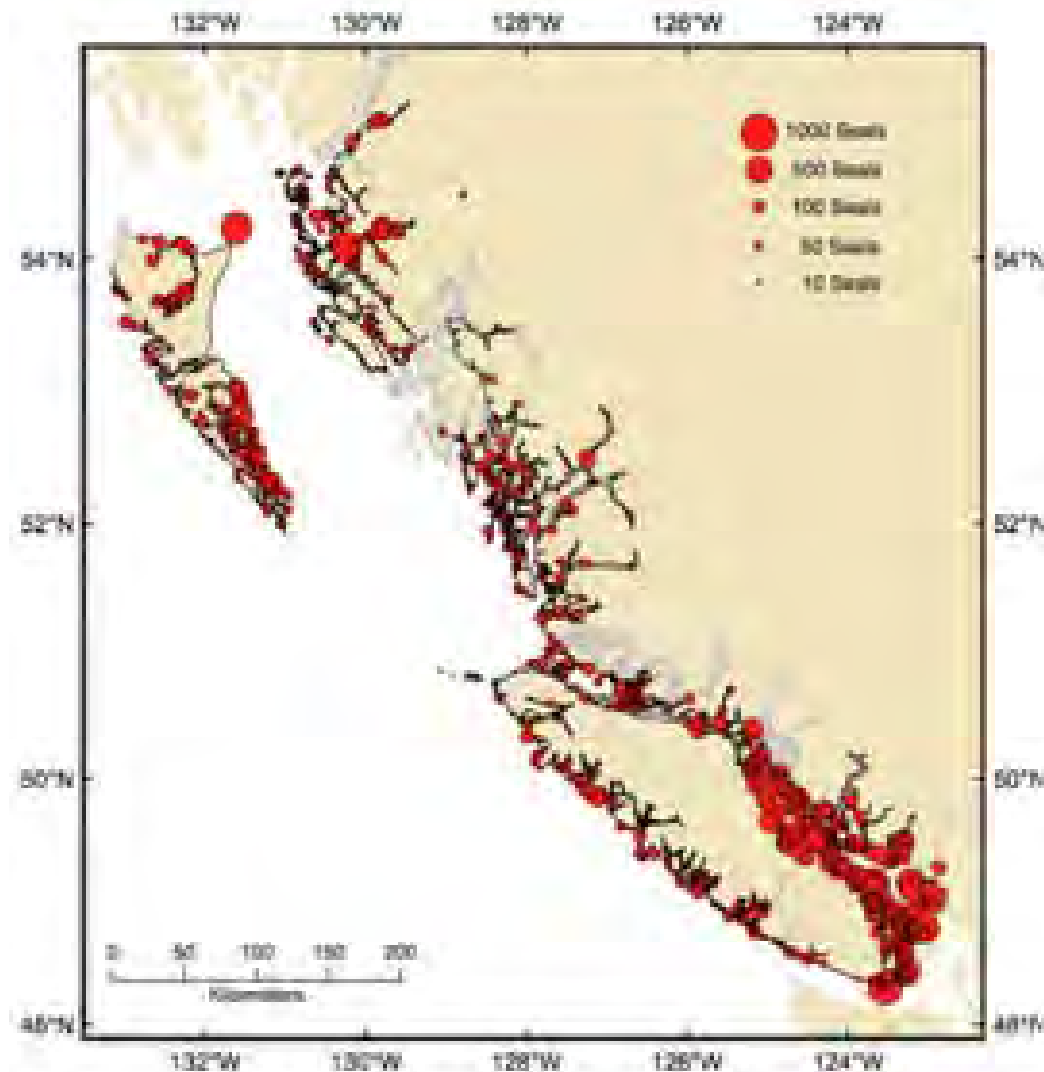
Harbour seal

Phoca vitulina



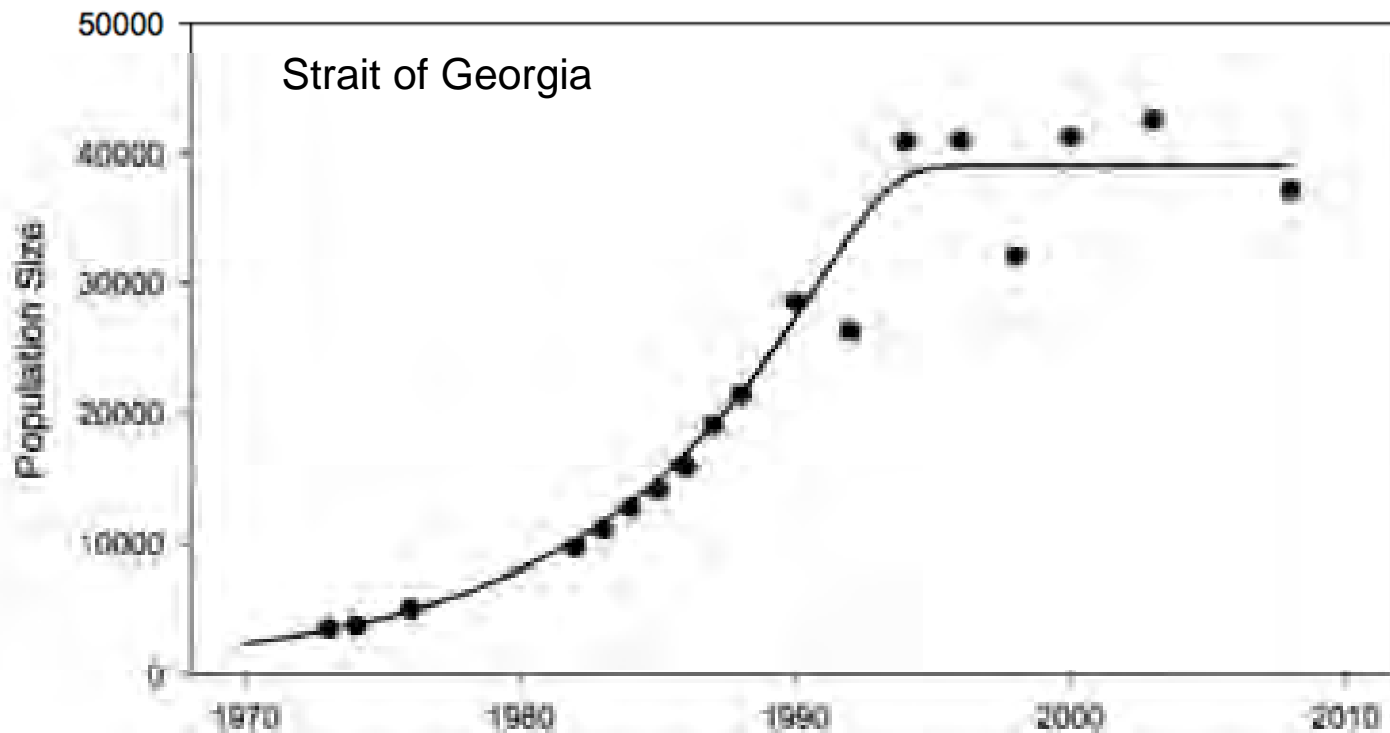
Distribution: Harbour seal

Harbour seal haulout sites in British Columbia



Status: Harbour seal

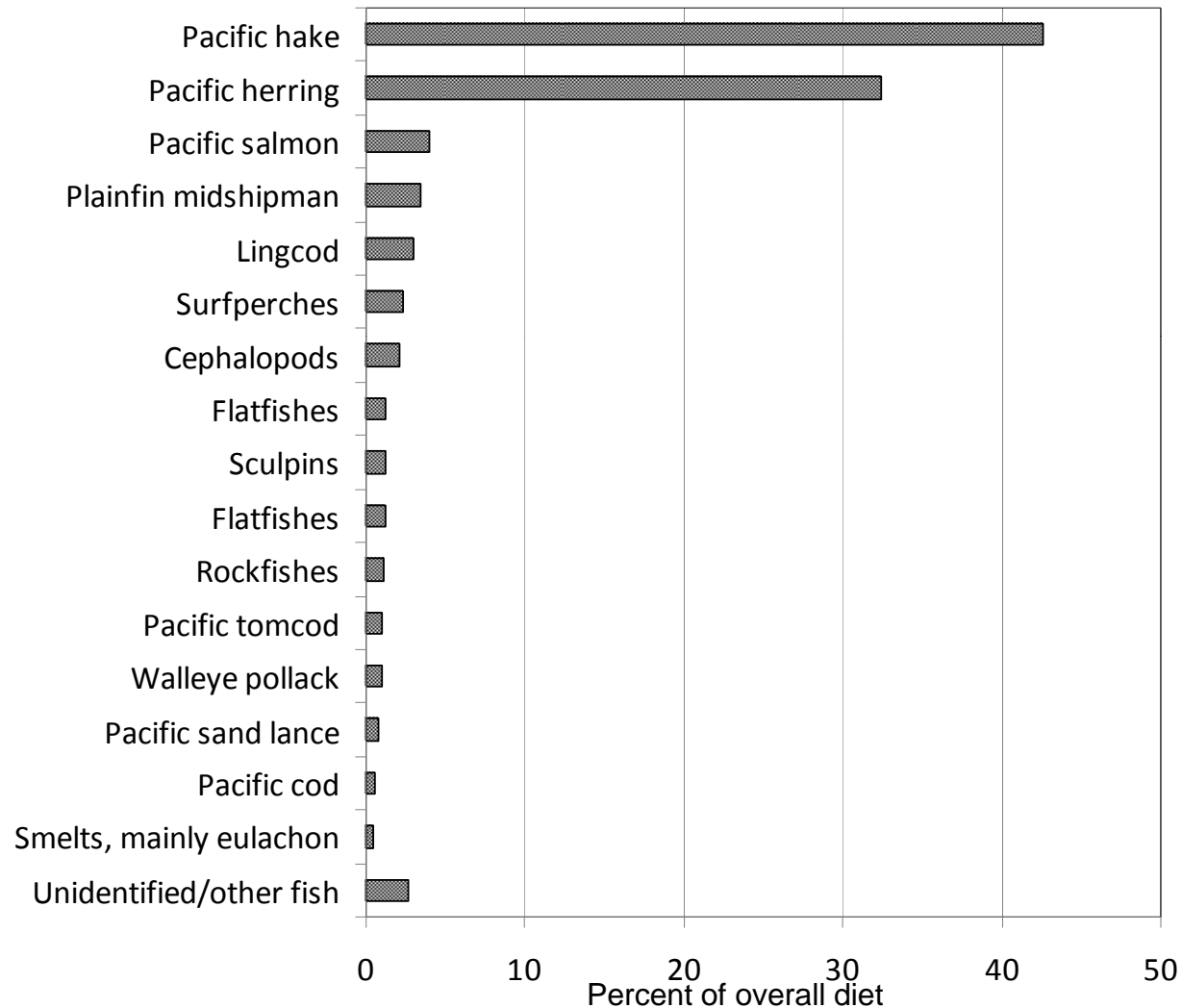
- Population severely depleted by control programs and harvest, ended in 1970
- Abundance increased 10-fold since early 1970s
- Increased at 11.5% per year before stabilizing in 1990s
- Current abundance: ca. 40,000 Strait of Georgia, 105,000 BC coast



Diet: Harbour seal

Average prey composition for harbour seals, Strait of Georgia

(n = 2,841 scat samples, collected 1982-88)



Conclusions: Harbour seal

- Primarily terminal predator on pre-spawning salmon (up to 65% of diet in estuaries during late summer and fall)
- Harbour seal predation compensatory (can impact small and depressed runs; e.g., Puntledge River chinook)
- Extensive predation on out-migrating smolts and fry appears to be restricted to artificial situations
- Given stable population abundance over last 15 years, apparently declining density in Fraser River estuary, and generally minor role of salmonids in diet, harbour seal unlikely to have significant role in recent sockeye declines

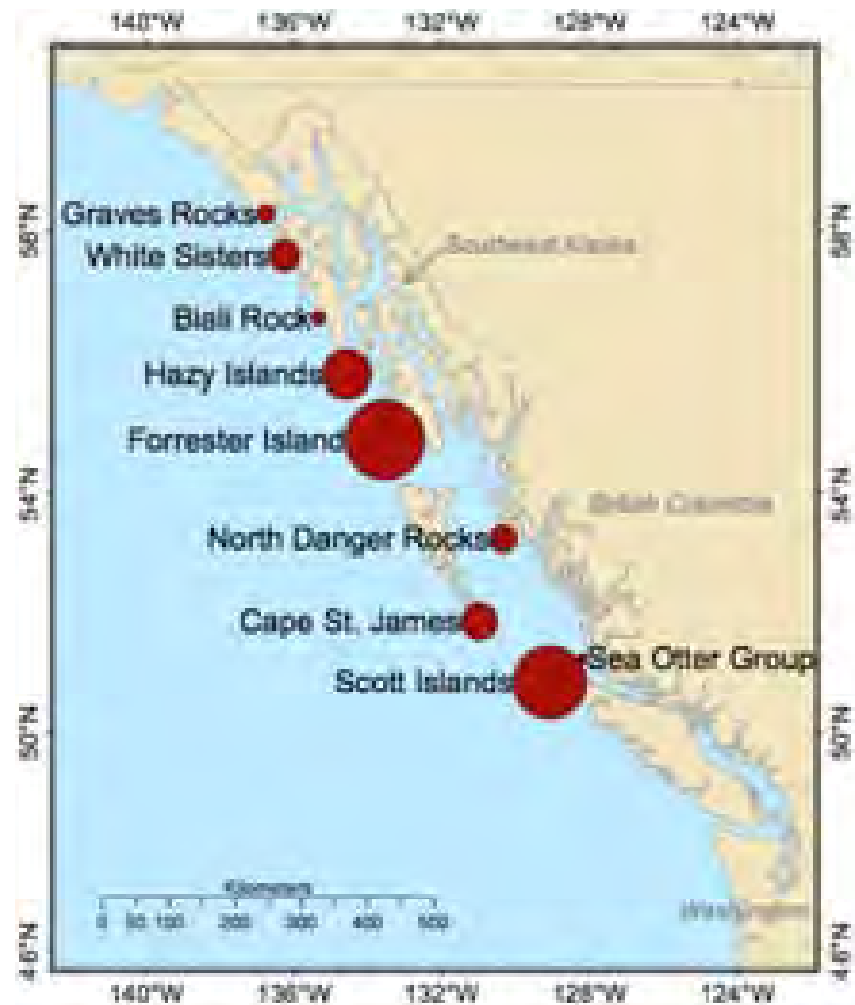
Steller sea lion

Eumetopias jubatus



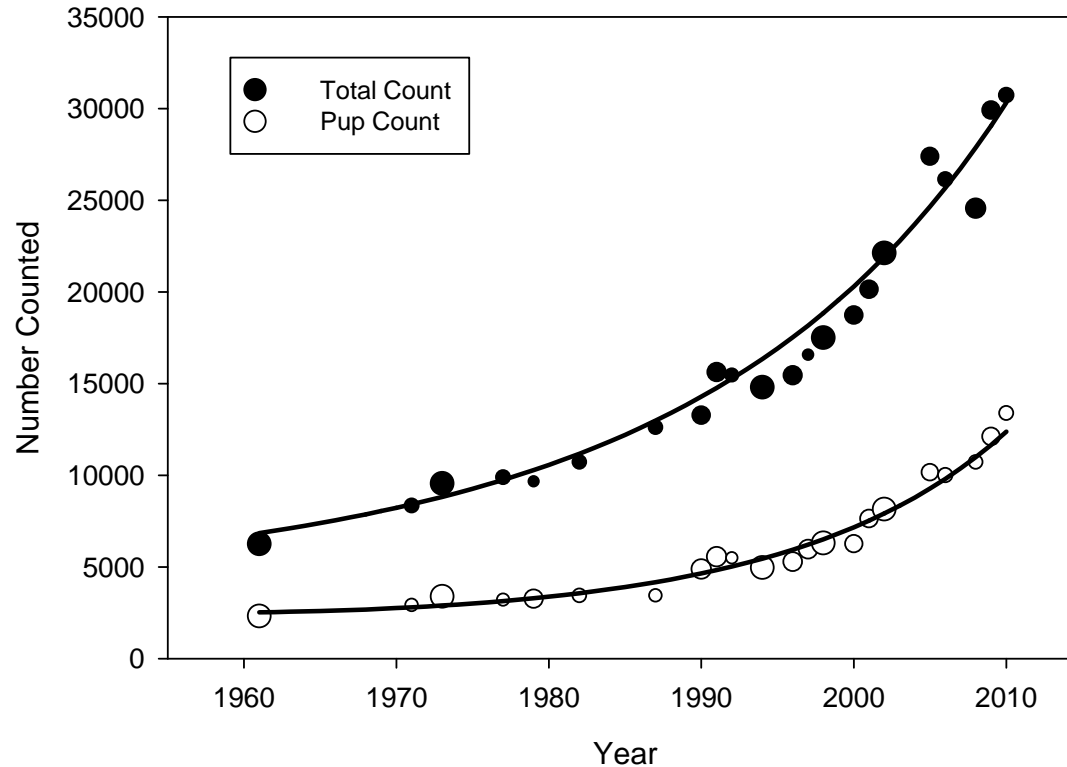
Steller sea lion distribution

Breeding rookeries in British Columbia and SE Alaska



Status: Steller sea lion

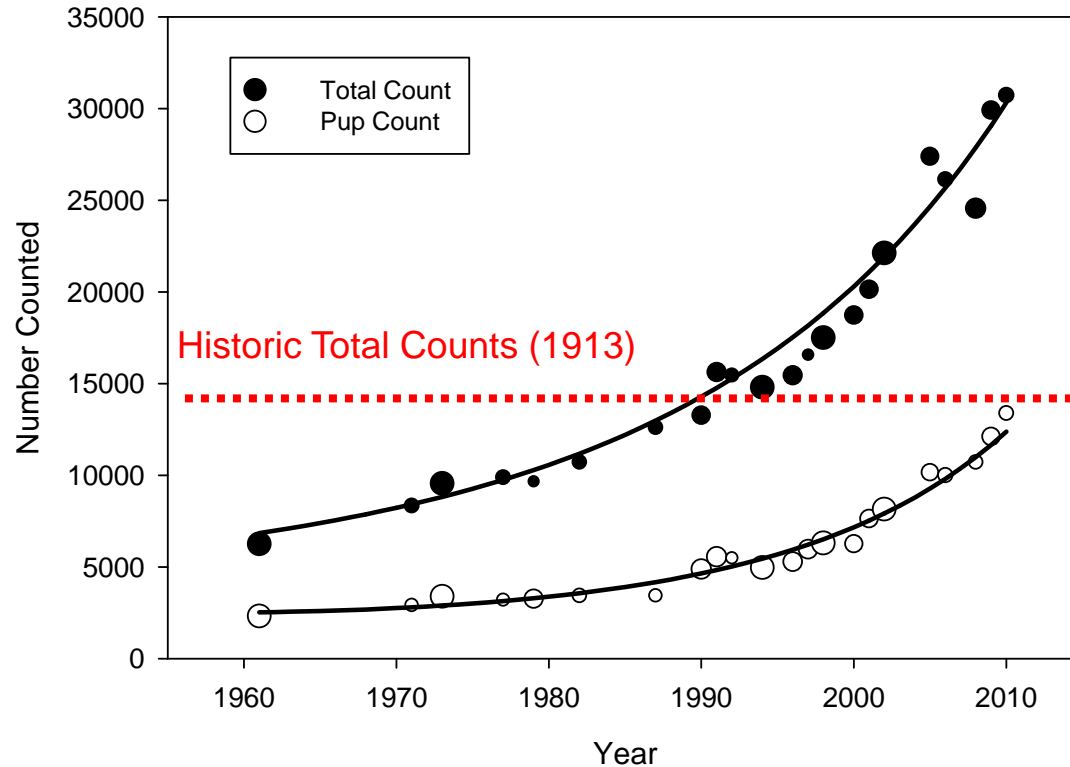
- Population depleted to 25-30% of historical abundance by control programs and harvests, 1912-1967
- Abundance increasing at 3.5% per annum (5% in recent years)
- Numbers in B.C. currently range from 32,000 in summer to 48,000 in winter



Olesiuk, P.F. 2011. Abundance of Steller sea lions (*Eumetopias jubatus*) in British Columbia. Can. Science Advisory Sec., Fisheries and Oceans Canada, Ottawa. Res Doc 2011/000.

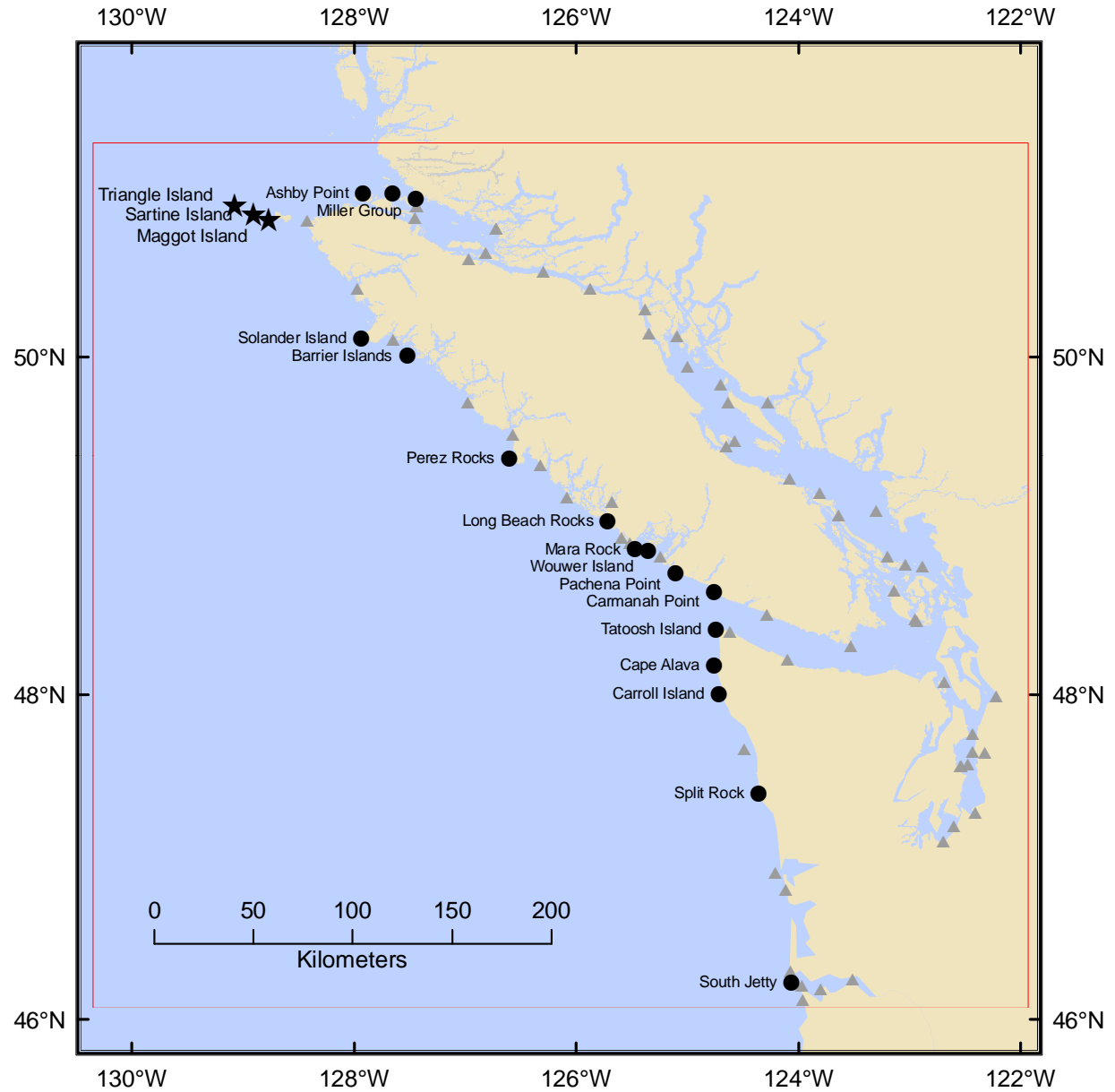
Status: Steller sea lion

- Population depleted to 25-30% of historical abundance by control programs and harvests, 1912-1967
- Abundance increasing at 3.5% per annum (5% in recent years)
- Numbers in B.C. currently range from 32,000 in summer to 48,000 in winter



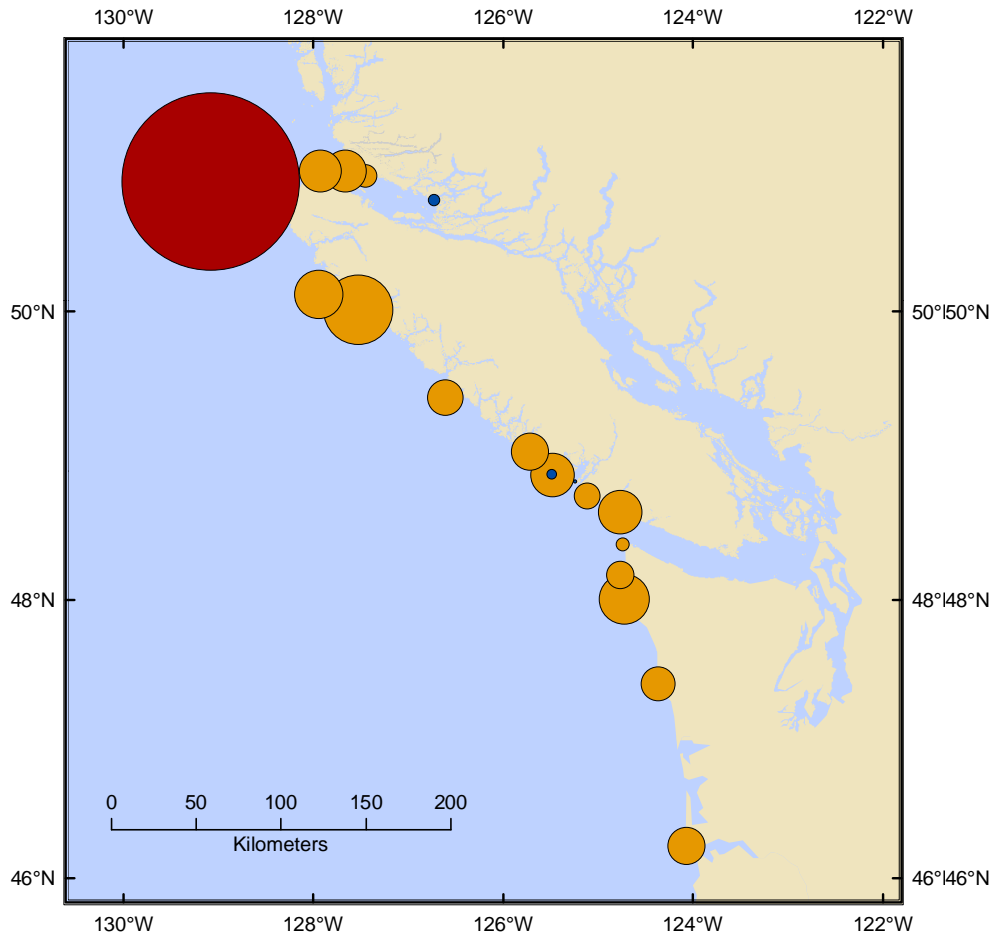
Olesiuk, P.F. 2011. Abundance of Steller sea lions (*Eumetopias jubatus*) in British Columbia. Can. Science Advisory Sec., Fisheries and Oceans Canada, Ottawa. Res Doc 2011/000.

PSC Study

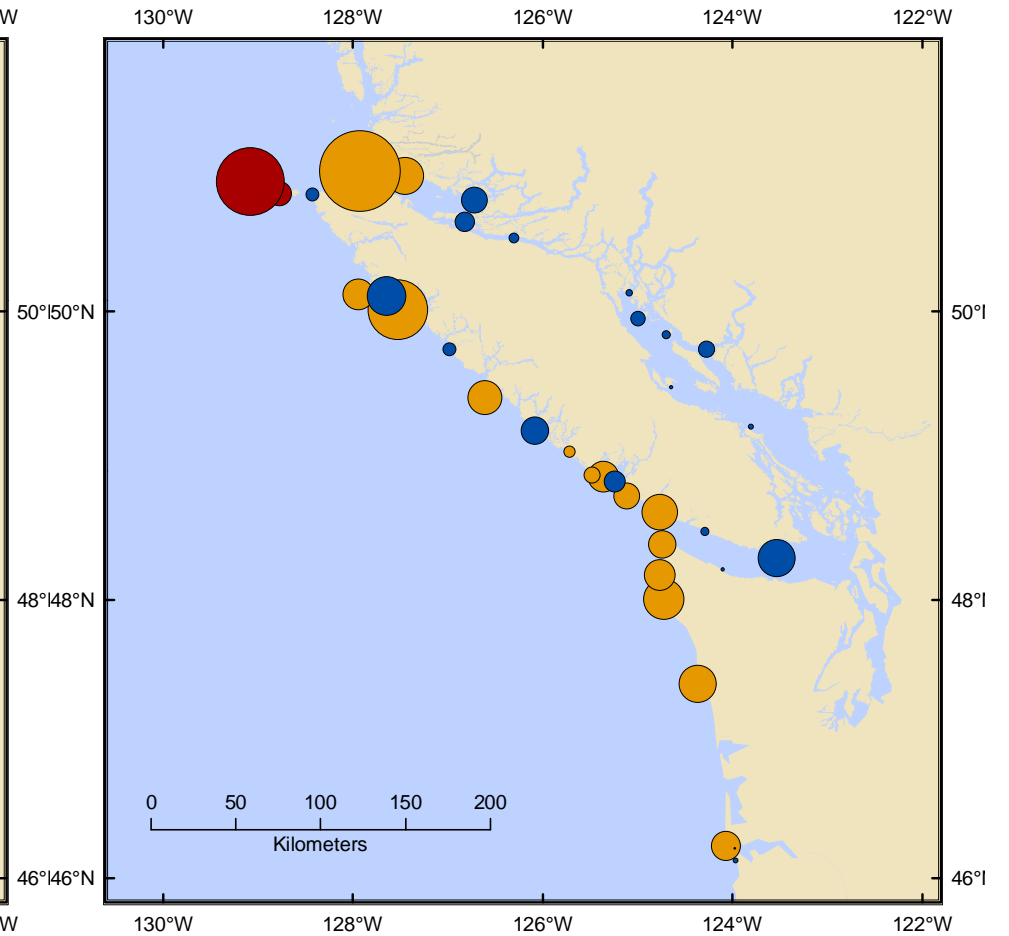


Steller Sea Lion - Seasonal Distribution

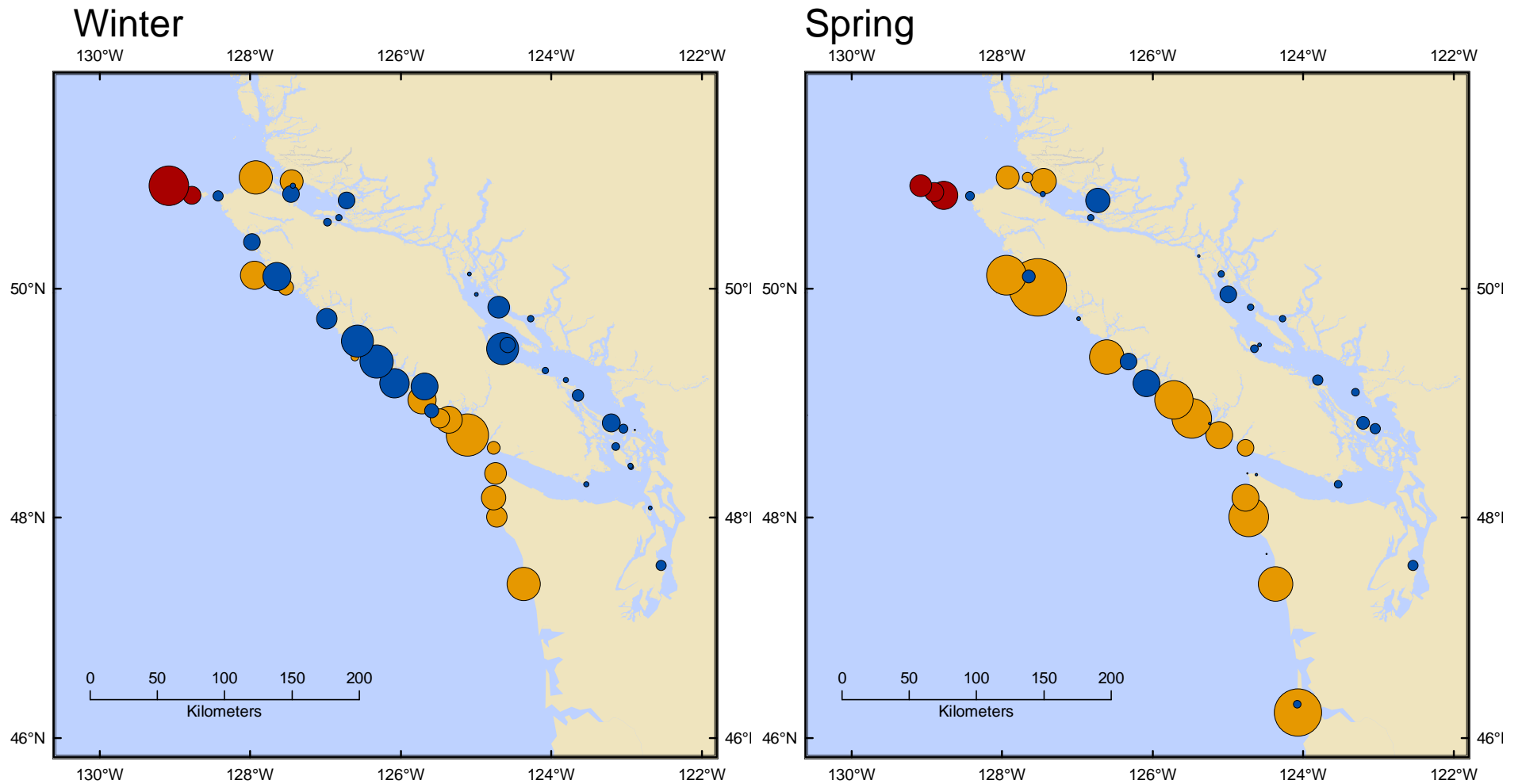
Summer



Fall



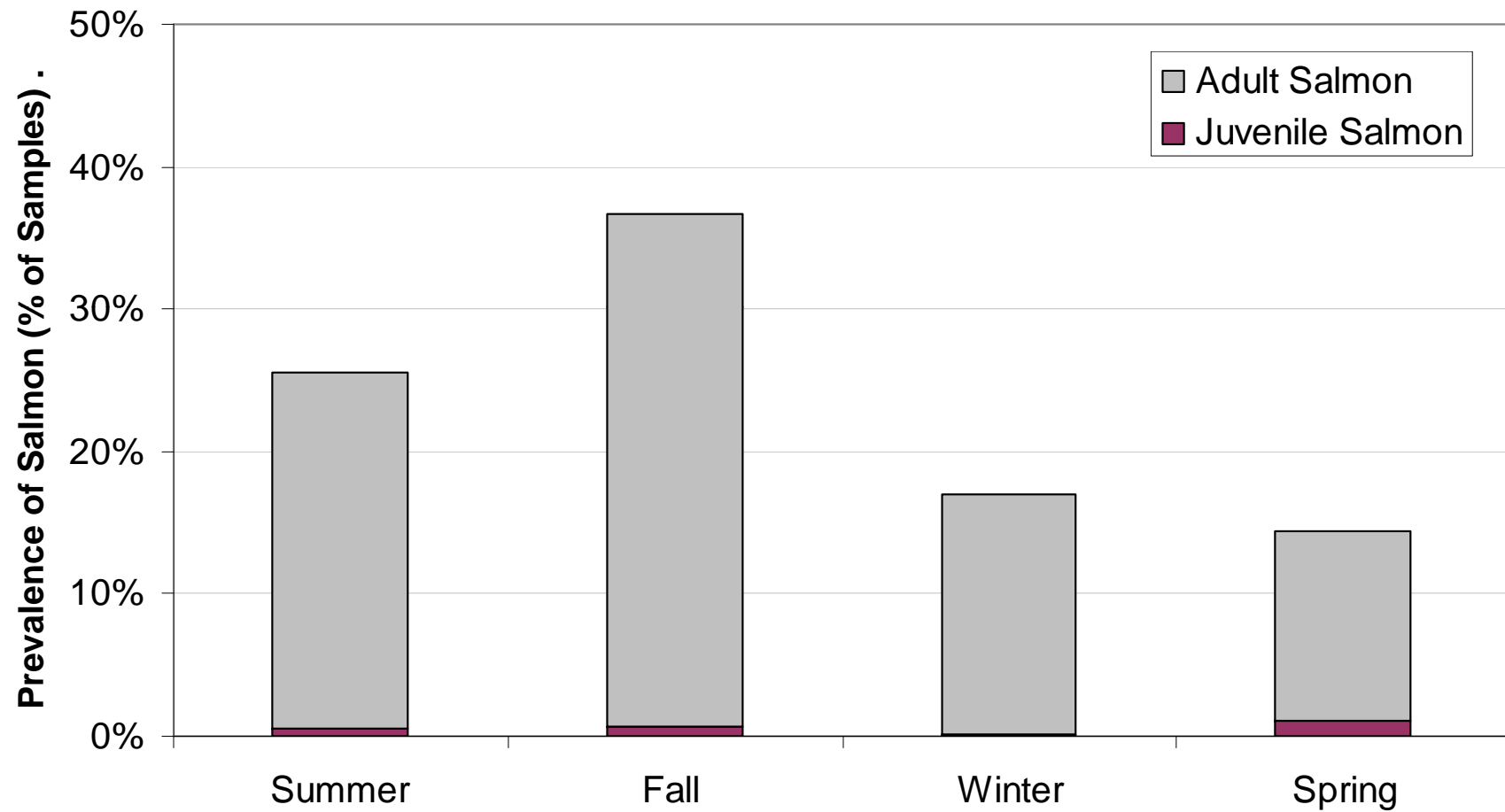
Steller Sea Lion - Seasonal Distribution



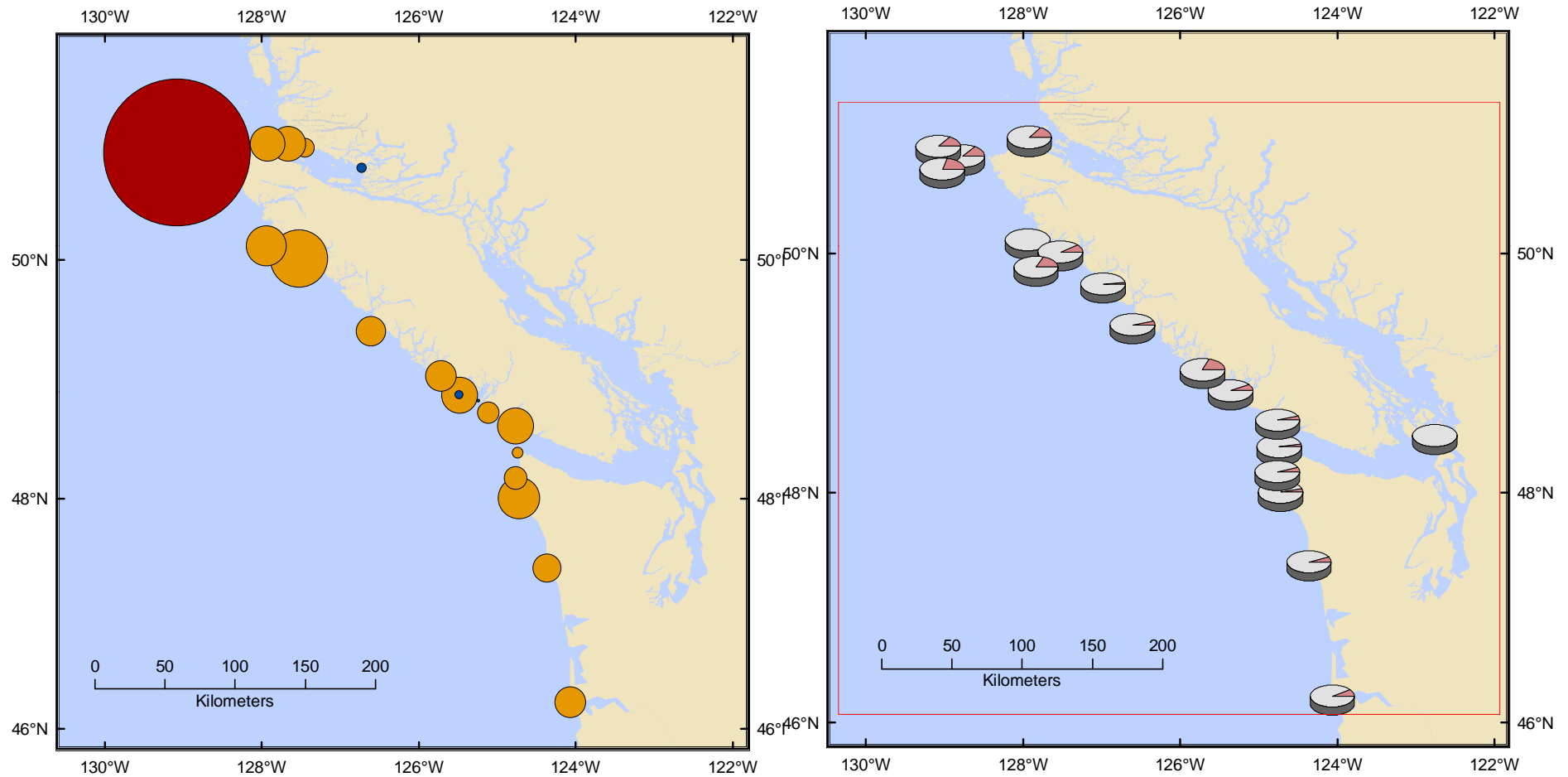
Steller Sea Lion - Daily Prey Requirements

- **Young-of-year:** 4 kg to 15 kg by first spring (17-23% body mass)
- **Adult females:** 15 kg (16 kg pregnant; perhaps up to 30 kg while lactating) (5.3% body mass)
- **Adult males:** 28 kg (15 kg summer to 33-34 kg outside breeding season) (4.1% of body mass)
- **Overall per capita:** 18 kg
- **Annual Consumption:** 161,000 tonnes (CV ~22-25%)

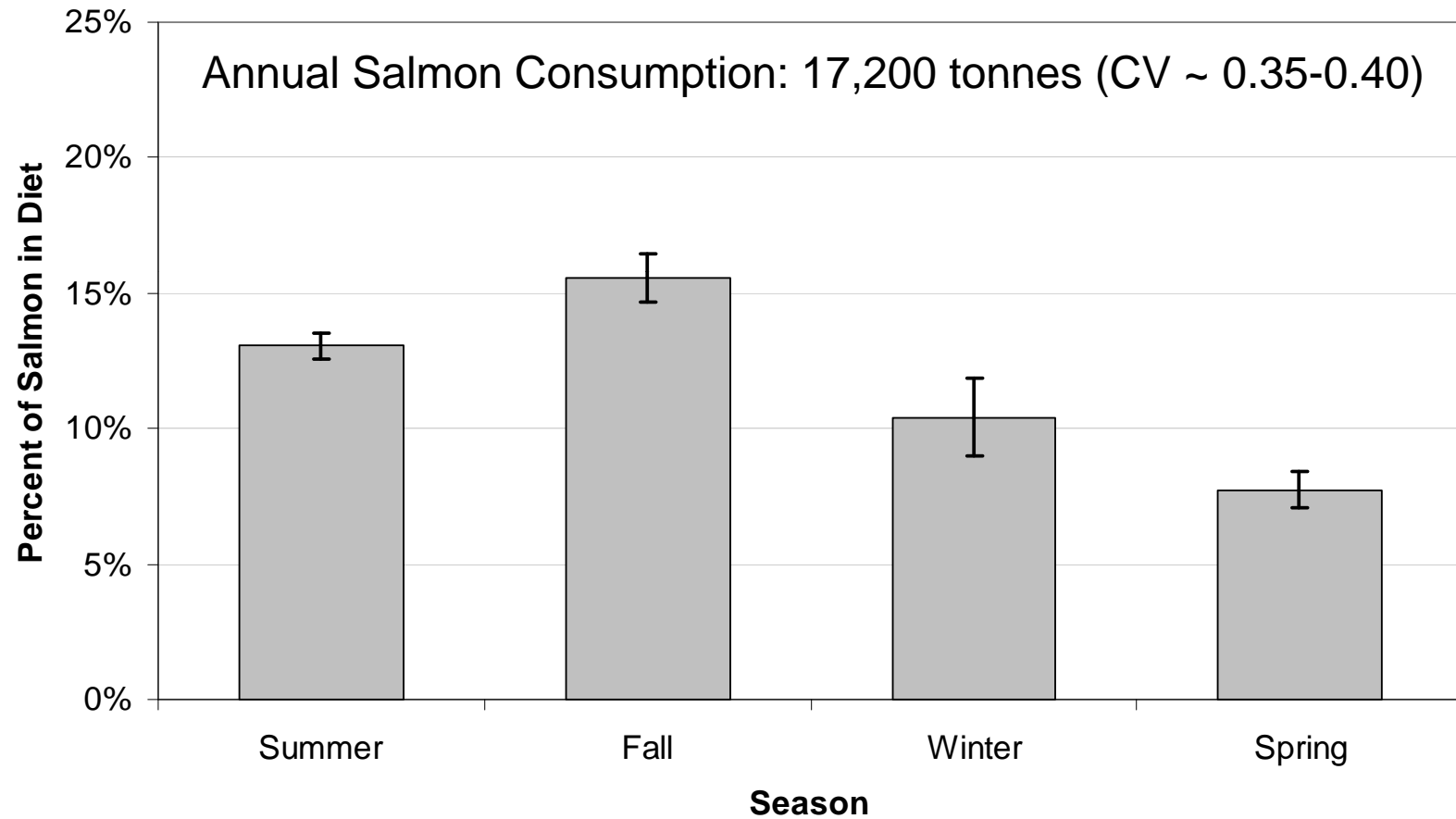
Seasonal Prevalence of Salmon



Salmon Predation - Summer

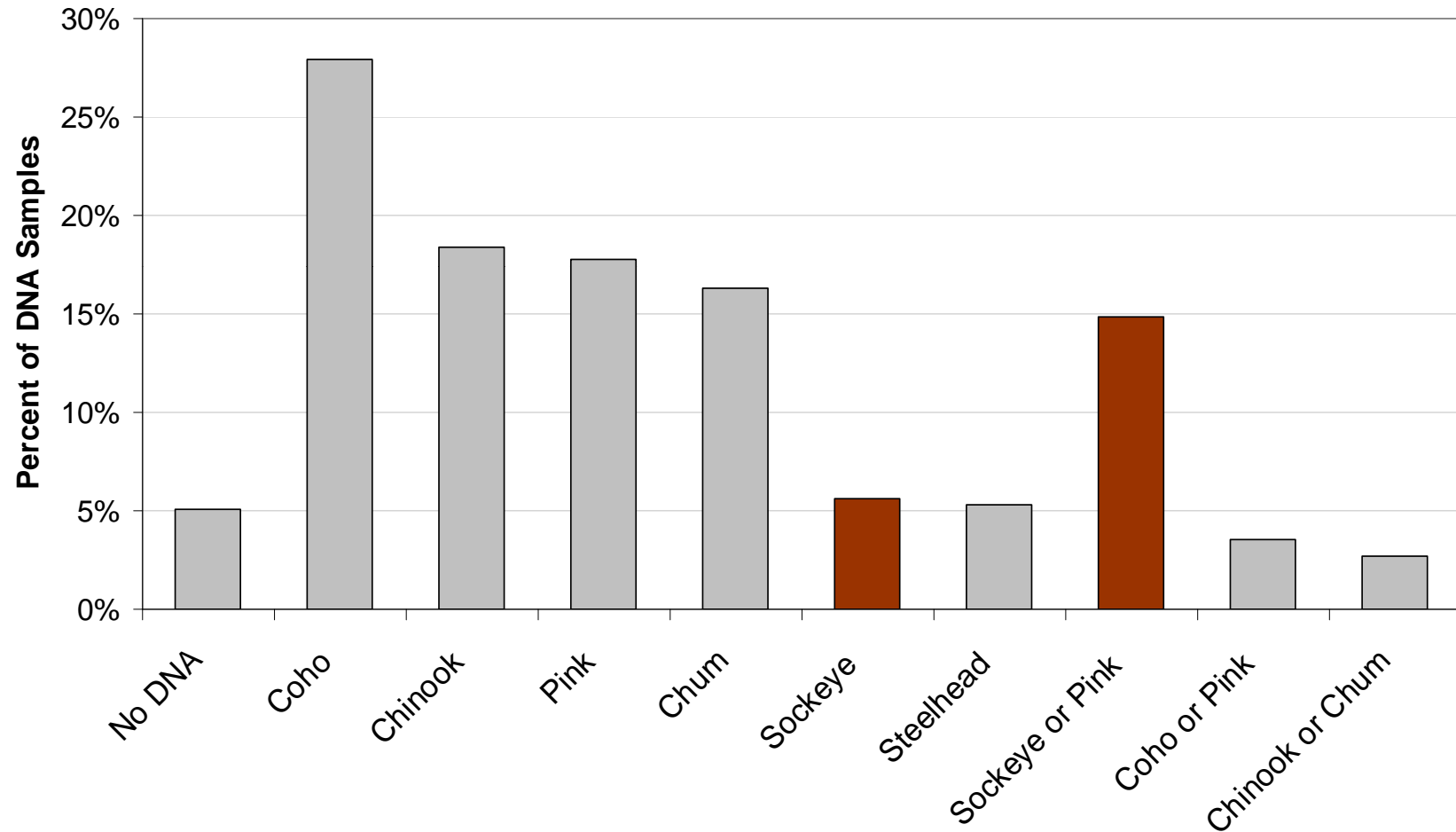


Proportion of Salmon in Diet



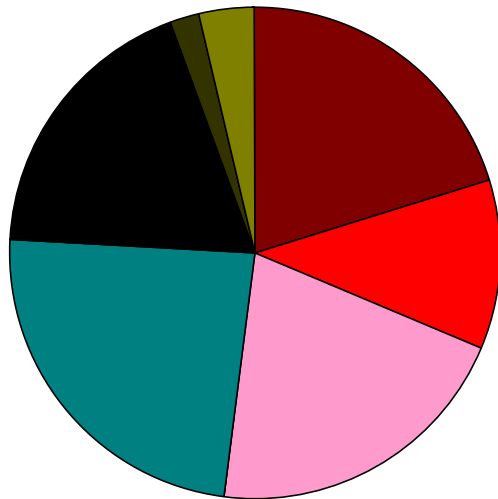
Species of Salmon (DNA)

(Preliminary results based on 1/3 of available samples analyzed to date)

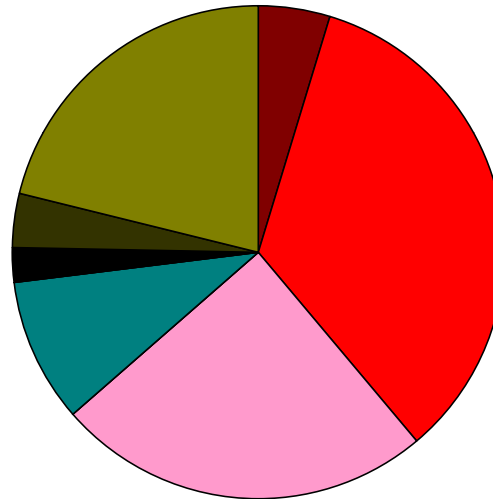


Species of Salmon - Sockeye Summer

Summer - Scott Islands (n=54)



Summer - West Coast Vancouver Island (n=85)



July 2009: 3/28 samples were sockeye and 5/28 samples were sockeye or pink

Conclusion: Steller sea lion

- Salmon a significant component of diet
- Increasing abundance of sea lions likely associated with increasing predation rates on salmon
- Opportunistic predators and consume all species of salmon and wide variety of other prey
- No evidence sea lions played key role in poor sockeye returns in 2009

Salmon Predation by Marine Mammals in British Columbia

Species	Abundance	Trend	Daily Prey Requirements (kg)	Annual Consumption (millions kg)	Percent Salmon	Eat Sockeye
Harbour Seals	105,000	Stable	1.9	75	4%	Some
Pacific White-Sided Dolphins	~26,000	Δ Distribution	~8	~75	?	Yes
Resident Killer Whales	326	Increasing	75	8	100%	Very Few
Steller Sea Lions	32,000-48,000	Increasing	18	250	11%	Some

The End

