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Salish Sea Ecosystem Conference

2014 Salish Sea Ecosystem Conference
(Seattle, Wash.)

May 1st, 3:30 PM - 5:00 PM

Modelling Ecosystem Processes Acting On Upper Trophic Level Managed Species in the Salish Sea – Lessons Learned and Future Goals

David Preikshot
Madrone Environmental, dave.preikshot@gmail.com

Christopher James Harvey
Northwest Fisheries Science Center (U.S.)

Richard Ian Perry
Canada. Department of Fisheries and Oceans

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Modelling Ecosystem Processes in the Salish Sea

Lessons Learned and Future Goals for Salmon

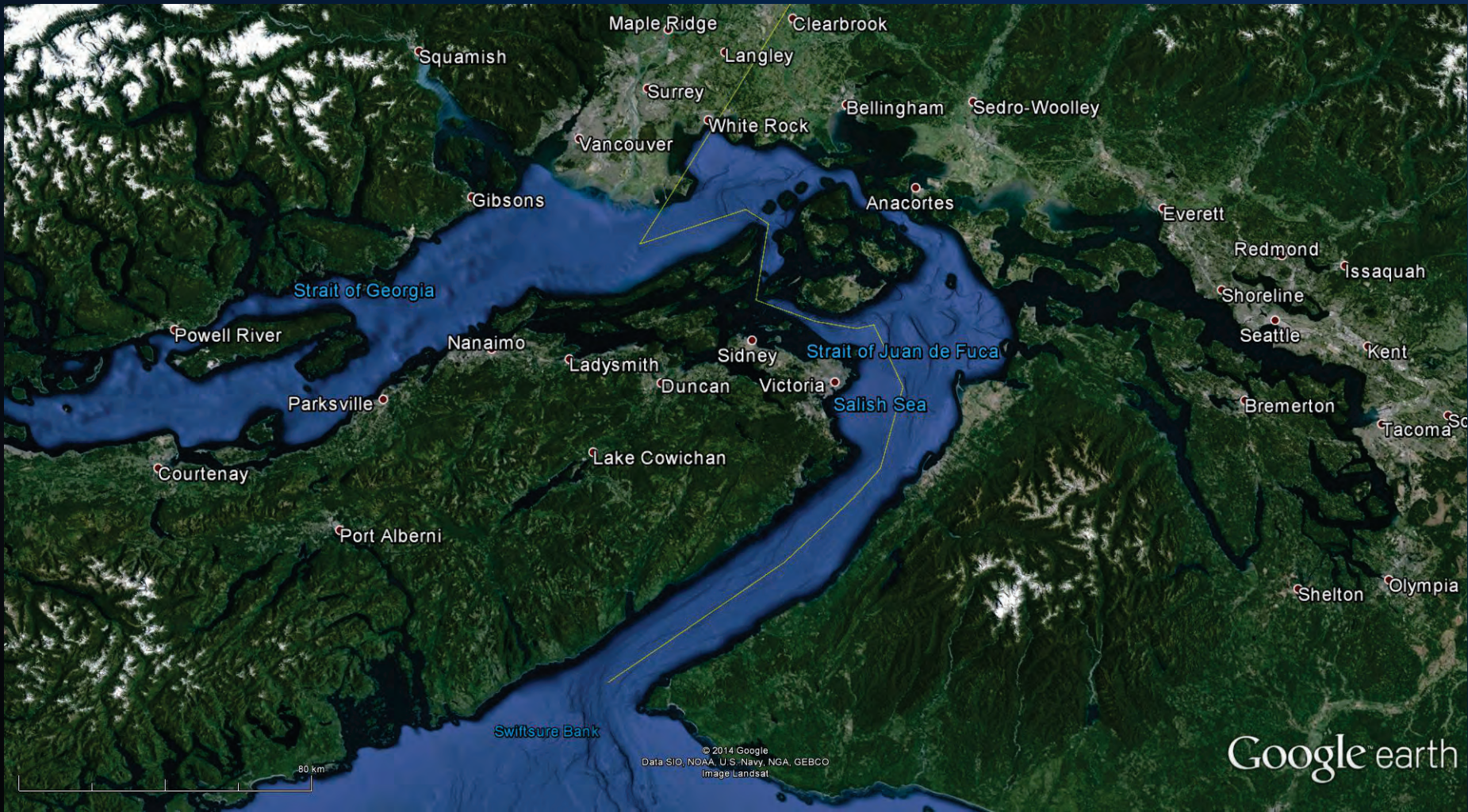
Research and Management

Dave Preikshot,
Madrone Environmental Services
dave.preikshot@madrone.ca

Chris Harvey,
National Marine Fisheries Service / NOAA
chris.harvey@noaa.gov

Ian Perry,
Fisheries and Oceans Canada
Ian.Perry@dfo-mpo.gc.ca

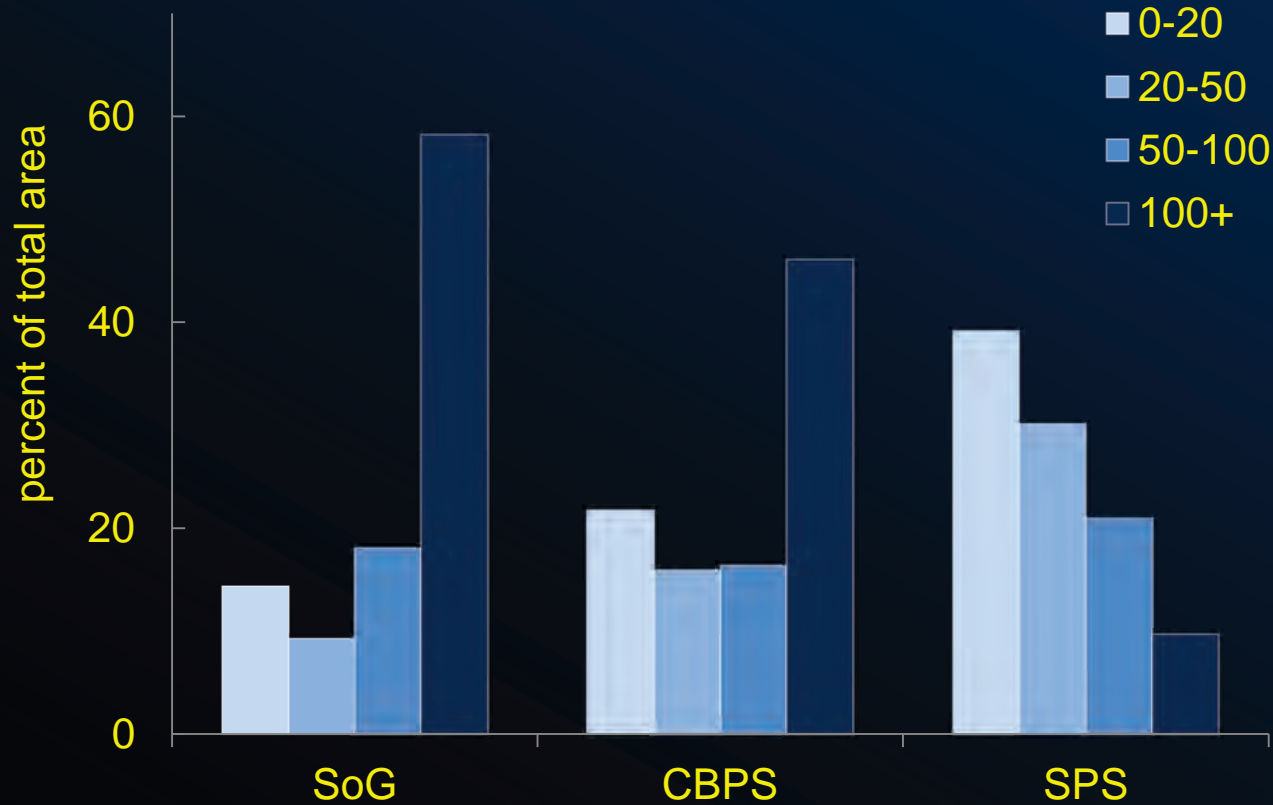




General Characteristics

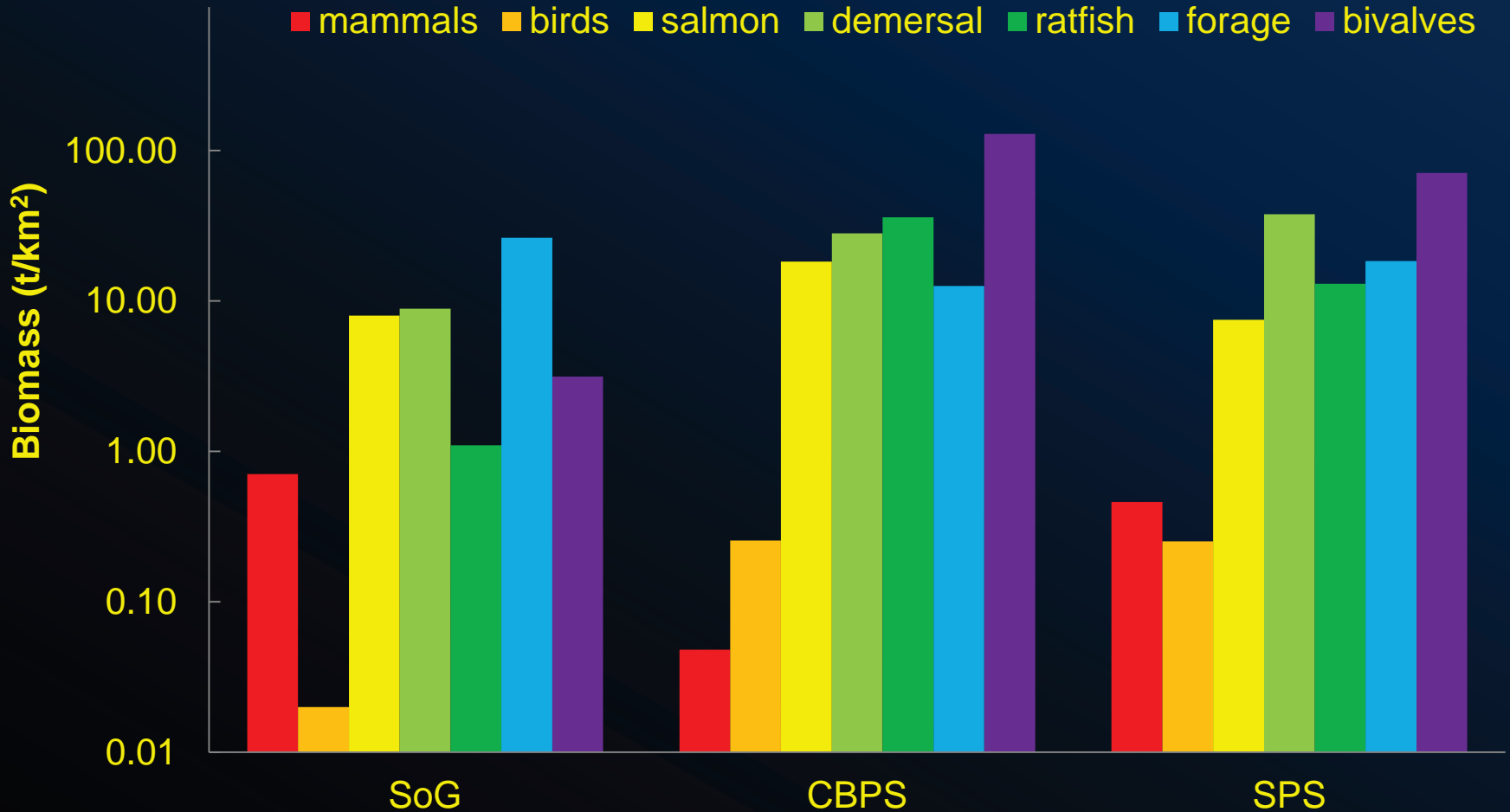
	St. of Georgia	Cent. Puget Sd.	S. Puget Sd.
Area (km ²)	8600	757	445
Max Depth (m)	450	280	187
Mean Depth (m)	155	62	42
Ecopath Model			
# of species	38	65	44
Focus Species	Coho, Chinook	Demersal fishes	Bivalves
Year(s)	1960, 2012	~2005	1970, 2012

% contribution of depth strata (m) to bathymetry



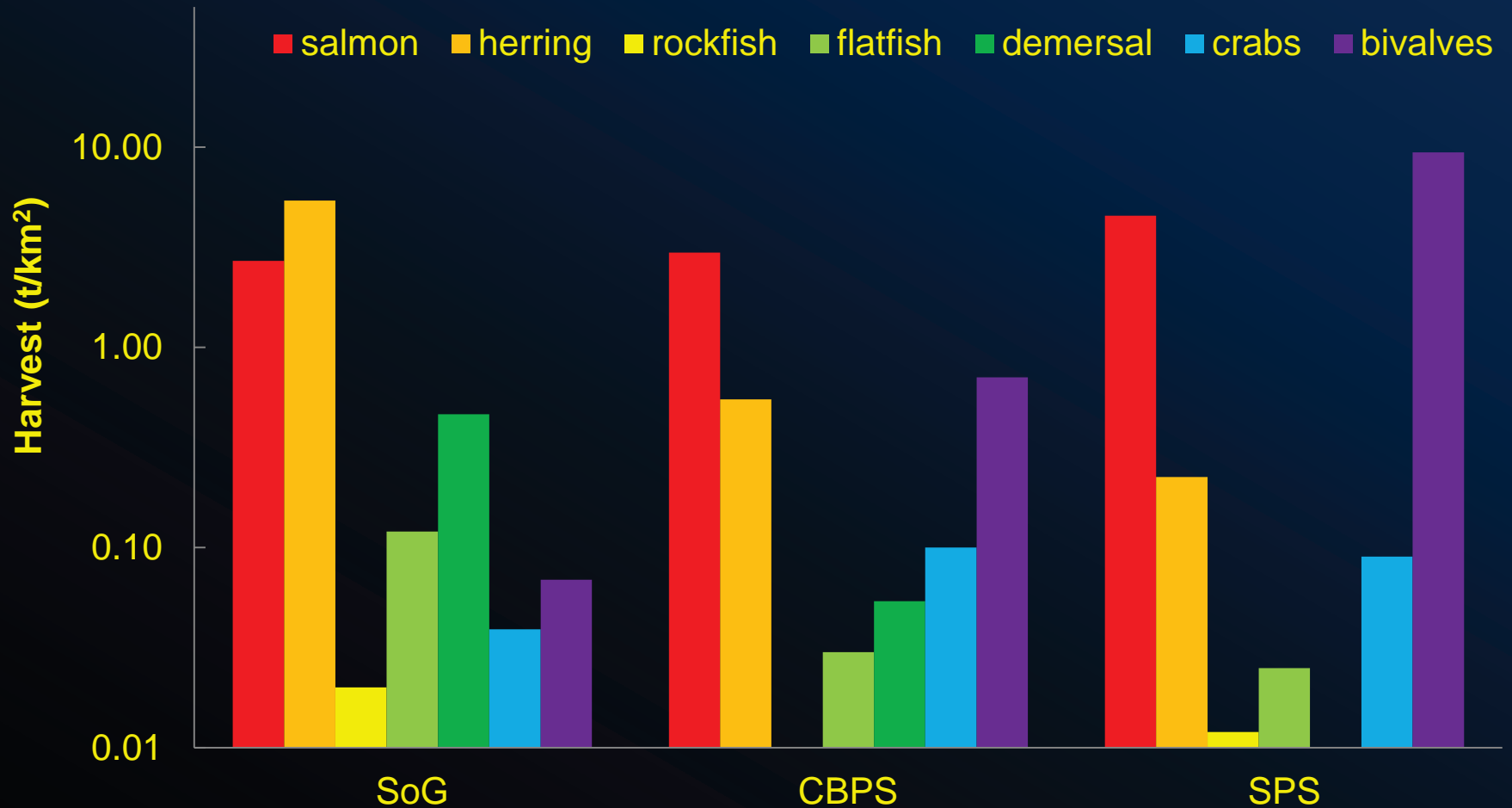
Biomasses of species by trophic groupings

(← ← higher to lower → →)



Harvests of major fisheries

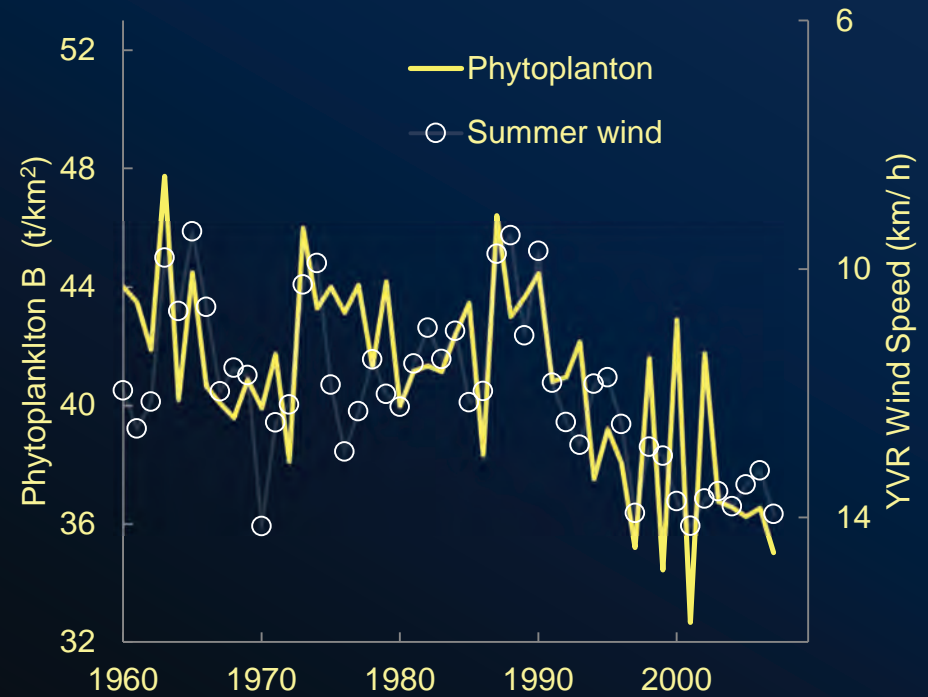
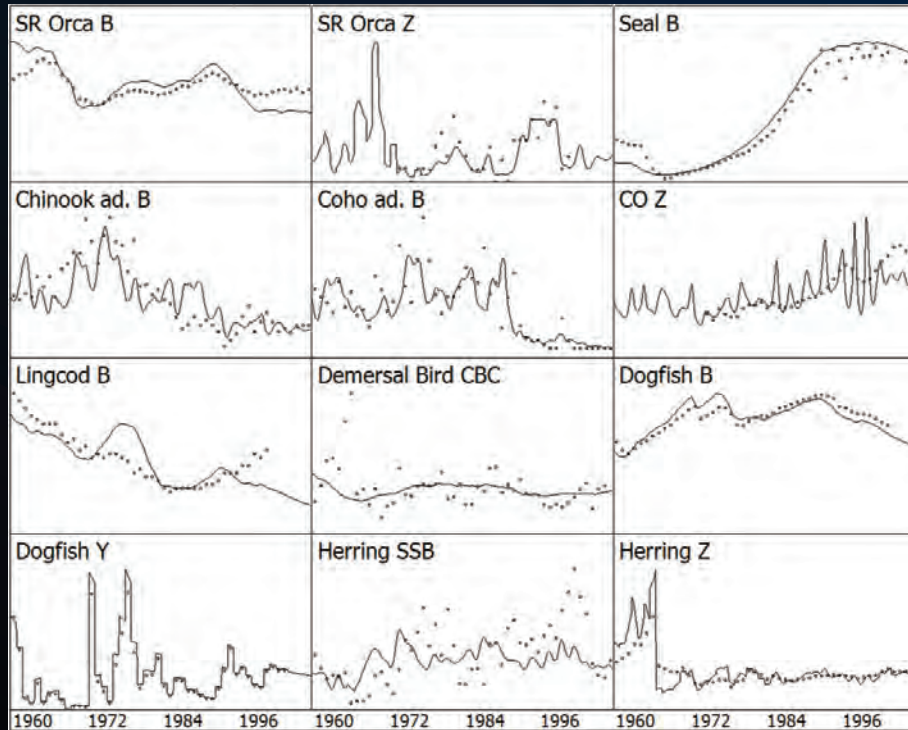
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Purpose and use of SoG model

- Examine historic ecosystem mechanisms influencing changes in Coho and Chinook Salmon populations
- Emphasis on interactions with predators, prey and competitors
- Examine potential future effects of climate change on ecosystem – level processes

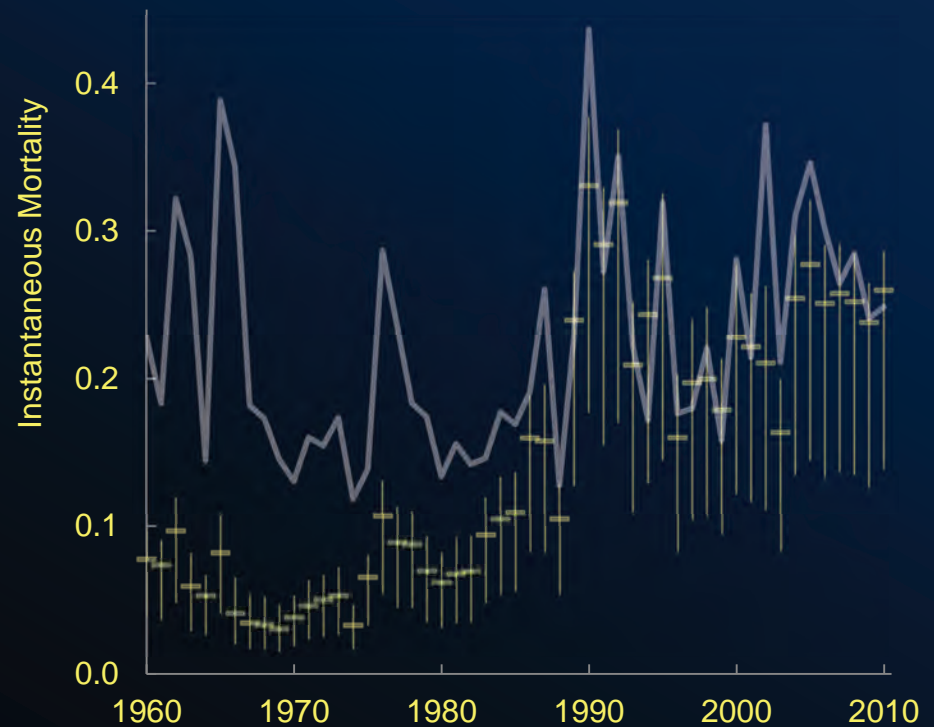
Ecosim emulation of historic SoG dynamics



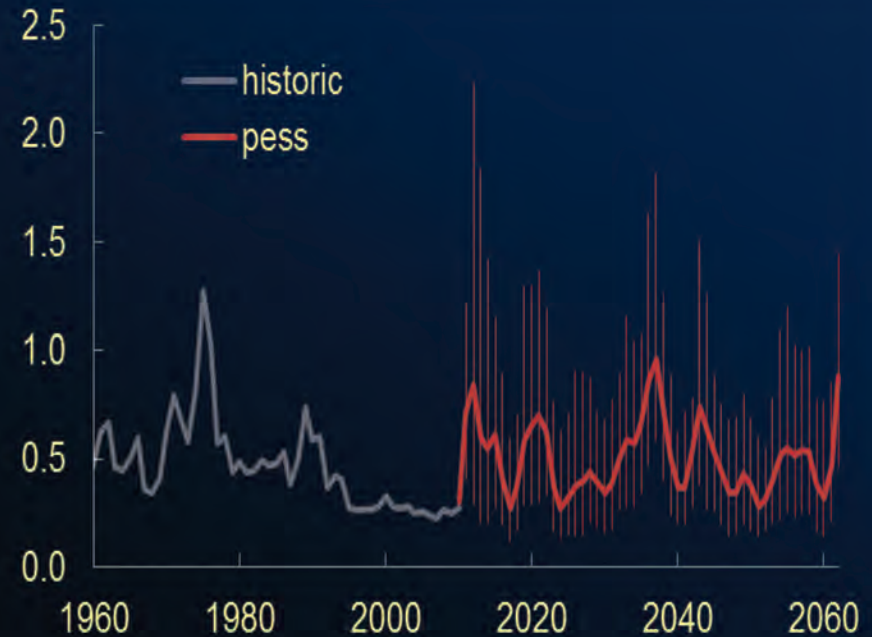
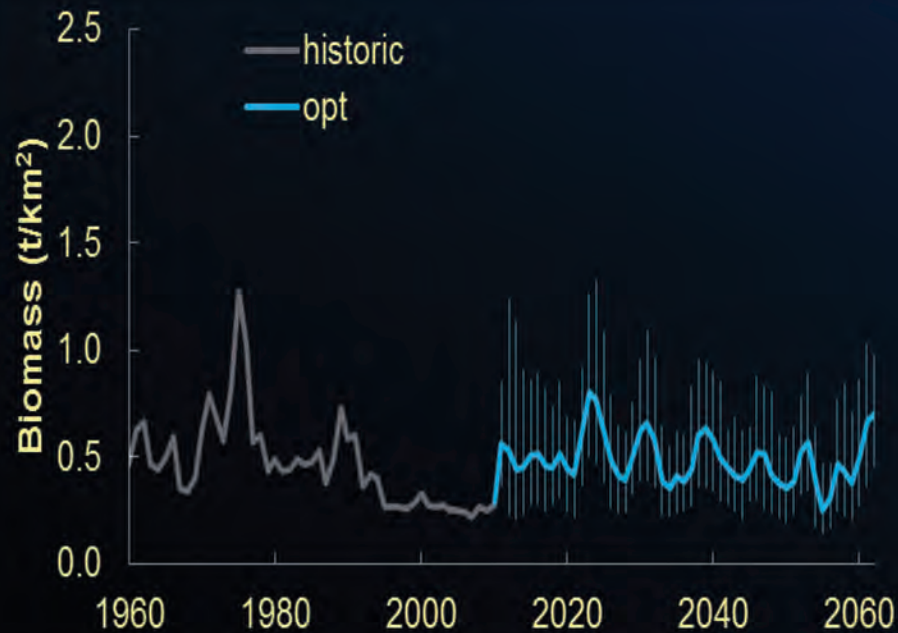
Simulating potential effects of mammal predation on Chinook Salmon

White line: Simulated chinook mortality caused by killer whale predation

Yellow lines: Low to high range of chinook mortality from varying seal/sea lion diet composition, yellow dash is the medium scenario



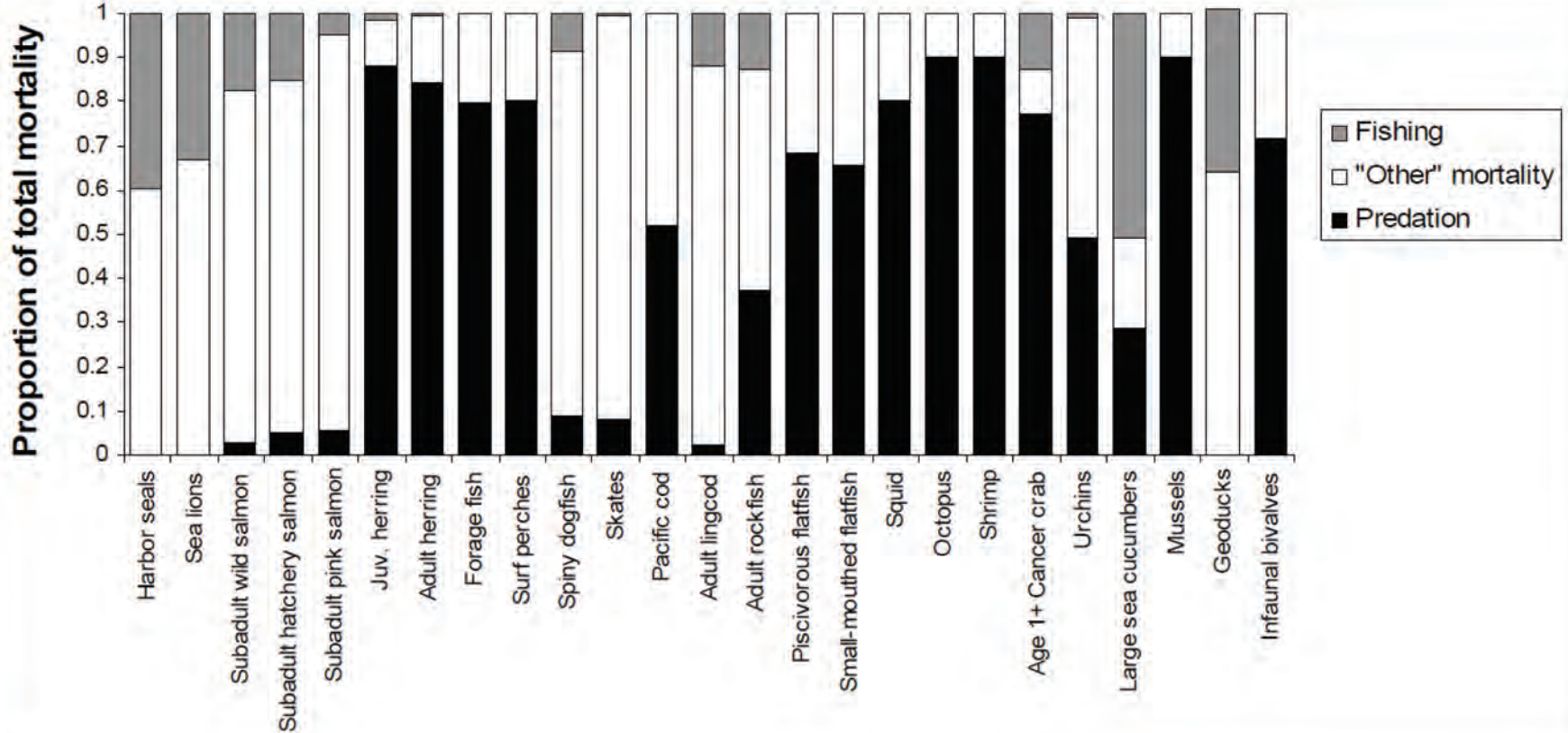
Ecosim forecasts of future changes in Coho Salmon biomass under optimistic (blue) and pessimistic (red) climate change scenarios



Purpose and use of CBPS model

- Support PSP goals by
 - identifying meaningful indicators that can be used to monitor the efficacy of management actions,
 - quantify risk,
 - simulate alternate ecosystem management scenarios.
- Uses include
 - partitioning of mortality in modelled species,
 - examining ecosystem effects of bottom up forcing,
 - Examine cascades from changes in key predators,
 - Examine potential effects of ocean acidification on the food web,
 - Estimating ecosystem services provided by eelgrass

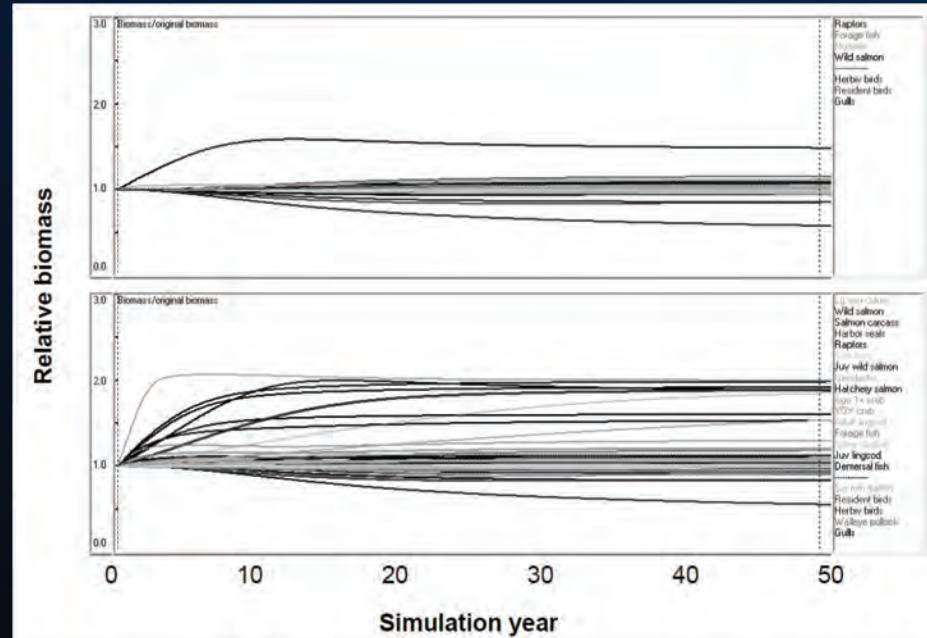
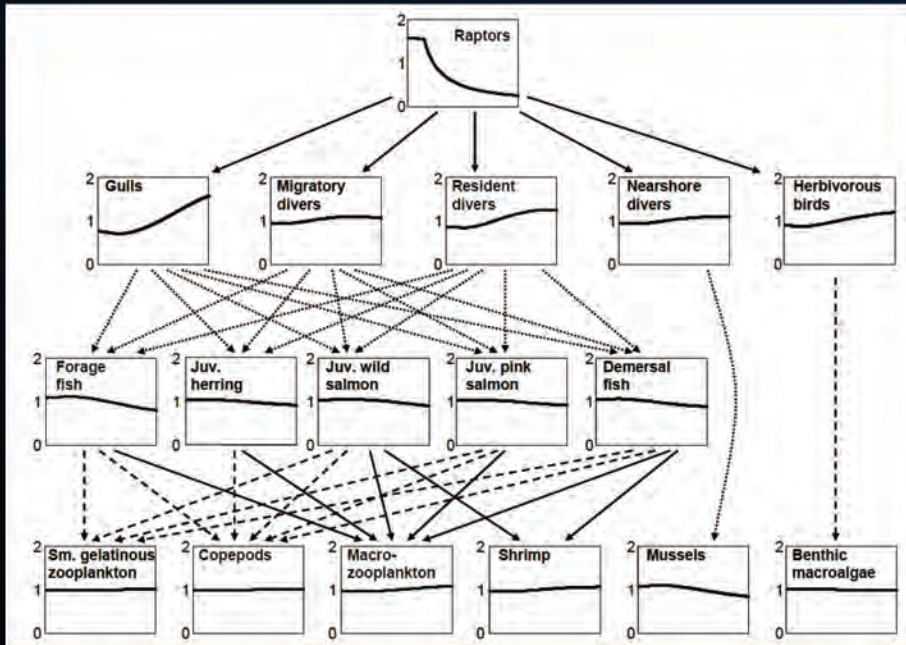
Examining sources of mortality on fished species in CBPS



Simulating top-down dynamics

Simulating a trophic cascade by imposing high mortality on raptors

Biomass forecasts from simulating fisheries continuing as at present (top) and with total fishing closure (bottom)



Purpose and use of SPS model



- Previous SPS ecosystem model built for NWIFC to examine changes in salmon populations
- Present SPS model will examine historic effects of shellfish harvest and aquaculture
- Examine potential ecosystem feedbacks from different shellfish management strategies
- Forecast likely ecosystem effects arising from bottom up forcing changes due to climate and regime shifts
- Significant detail in Pacific Salmon Groups

Benefits from synthesising results from Salish Sea models to salmon research and management

- In cases where the models suggest differing basin-level ecosystem mechanisms, we can improve management of migratory species, like salmon, by determining where basin-scale research and management is appropriate
- In cases where models suggest ecosystem mechanisms are the same we can determine when and where Salish Sea scale research and management will be optimal.
- Identification of common knowledge gaps in determining research priorities
- Identification of ecosystem indices useful at the scale of each basin and at the scale of the whole Salish Sea

Steps to synthesising model results

- Model all basins of Salish Sea: Hood Canal and Strait of Juan de Fuca need to be examined
- Develop a list of key species and associated species groups significant to all basins of the Salish Sea. Coho and Chinook may be most appropriate salmon species, due to residency in the Salish Sea
- Develop a common historic reference period to examine potential historic bottom-up and top-down influences on Salmon and other key species
- Use historic dynamics to develop simulations of future changes under different production regimes and how management policies can mitigate these changes
- Examine how future choices in management (or lack of management) may influence trade offs in abundances of different species