Coupling crustacean zooplankton production and primary production rates to estimate energy transfer in the NE Pacific

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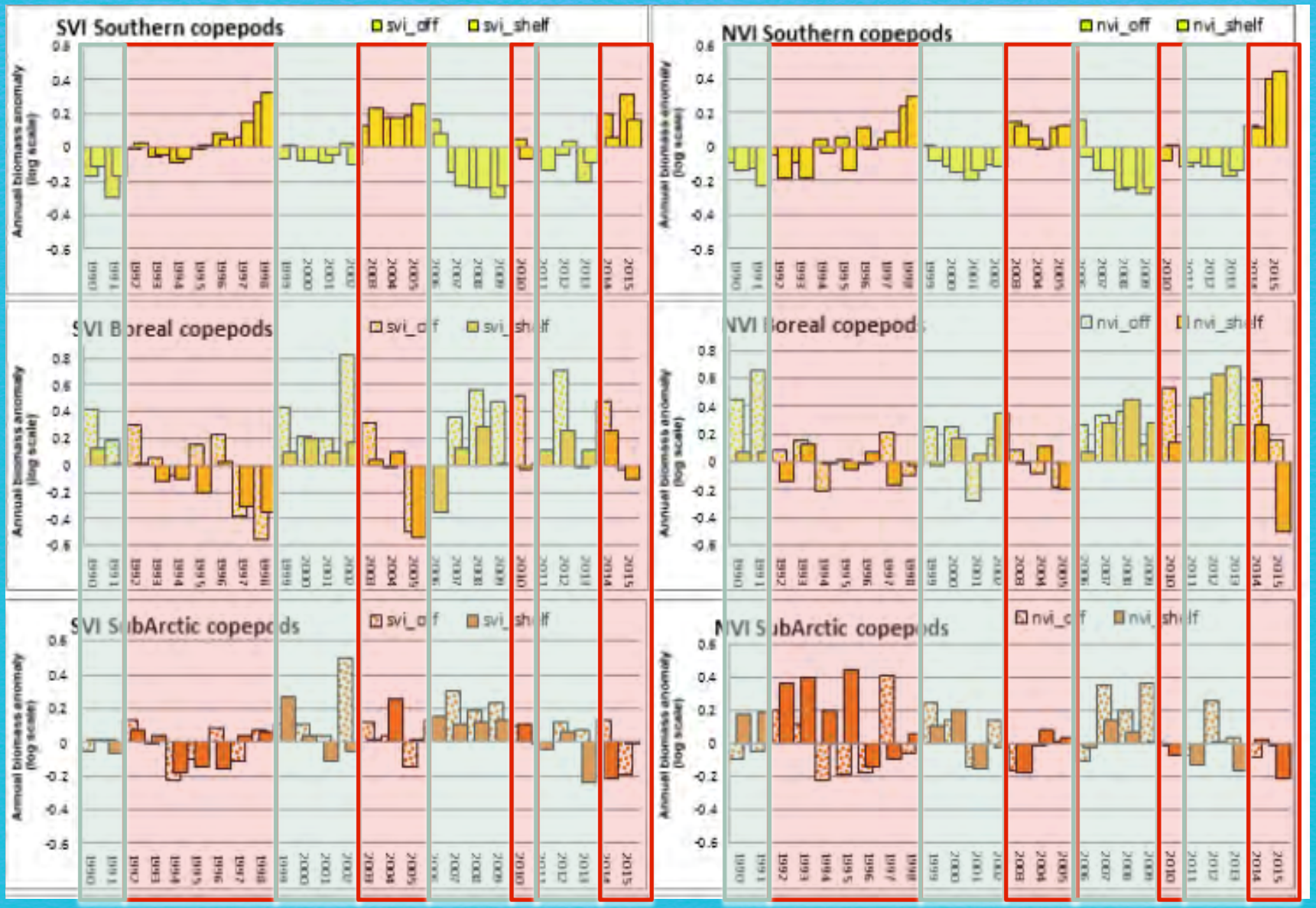
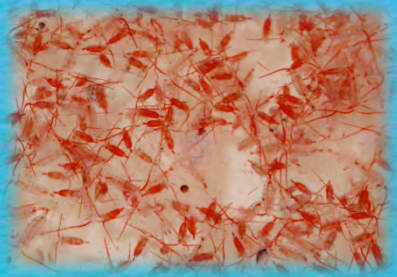
Copepod Biomass Anomalies



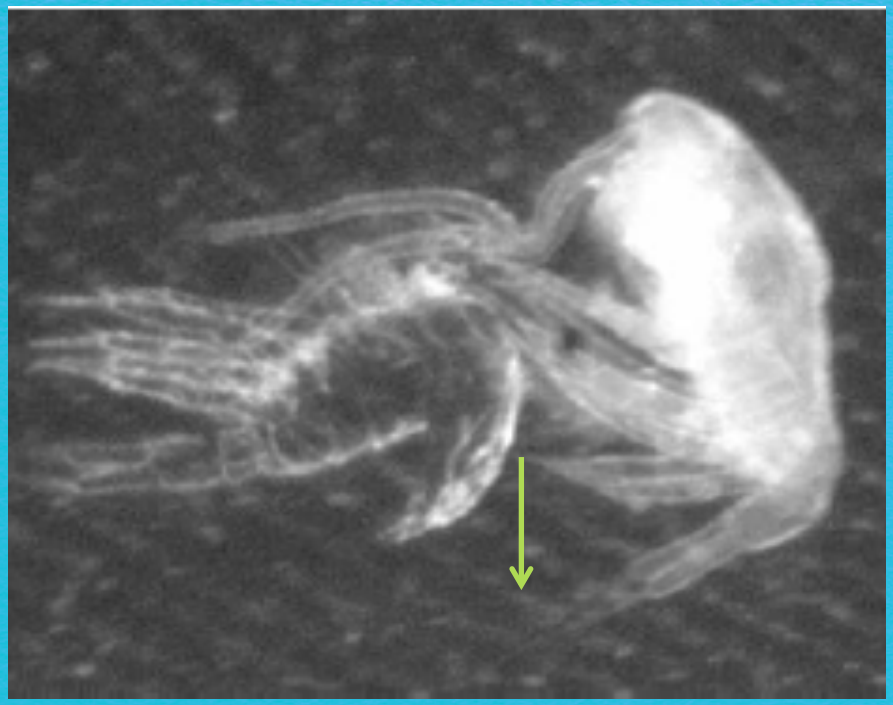
Galbraith et al *in*: Chandler, King, and Perry 2016, Can. Tech. Fish. Aquat. Sci

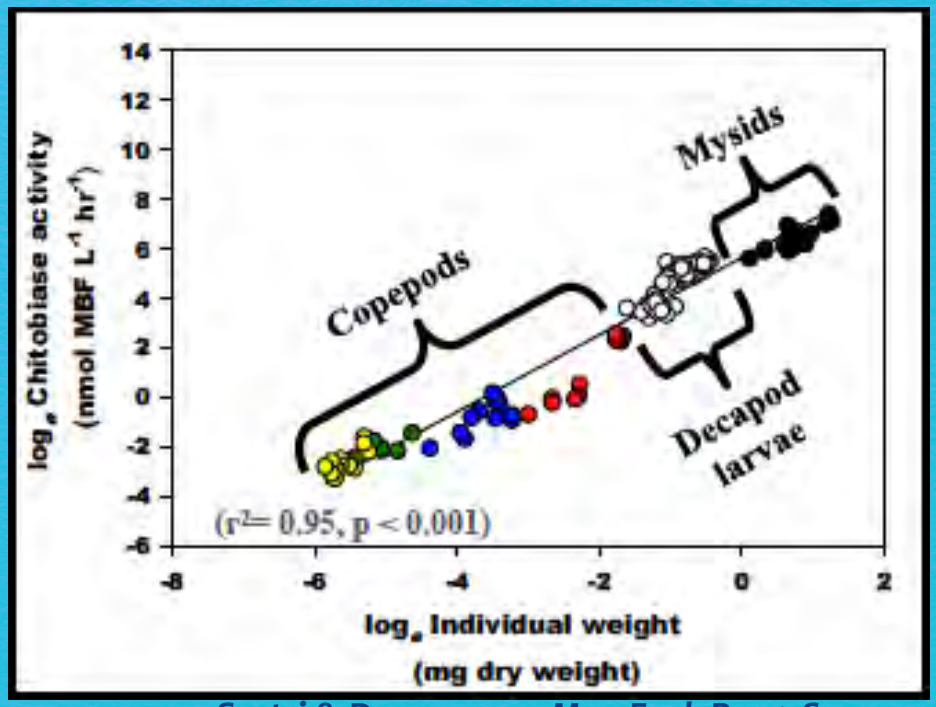
Zooplankton Production

- The rate at which biomass is generated
  - Focus on crustacean zooplankton production rates
- Key to understanding energy transfer to higher trophic levels
- Zooplankton production rates and transfer efficiencies are critical measures of ecosystem function that are not well understood



Chitobiase Method





Sastri & Dower 2009 *Mar. Ecol. Prog. Ser.*

Rate of production of chitobiase in water column = biomass production rate (BPR) of entire crustacean zooplankton community.

Energy Transfer

- Rate of crustacean zooplankton production divided by the rate of primary production = Ecological Efficiency (EE)
- Generally assumed to be 10% in marine ecosystems
  - Large variation observed
- Range of factors influence can influence transfer efficiencies
- A region's productivity is not necessarily indicative of its EE (or trophic transfer efficiency (TTE))

Location	TTE Range	Source
Indian Ocean	<1 - 35	Cushing 1973
Japan	7.4 - 16.2	Parsons and Chen 1994
World Fisheries Catch	2 – 24	Pauly and Christensen 1995
North Sea	3.7 – 12.4	Jennings et al. 2002
Southern Plateau, NZ	1.5 – 25.8	Bradford-Grieve et al. 2003
Saanich Inlet, BC	2 – 32	Suchy et al. 2016

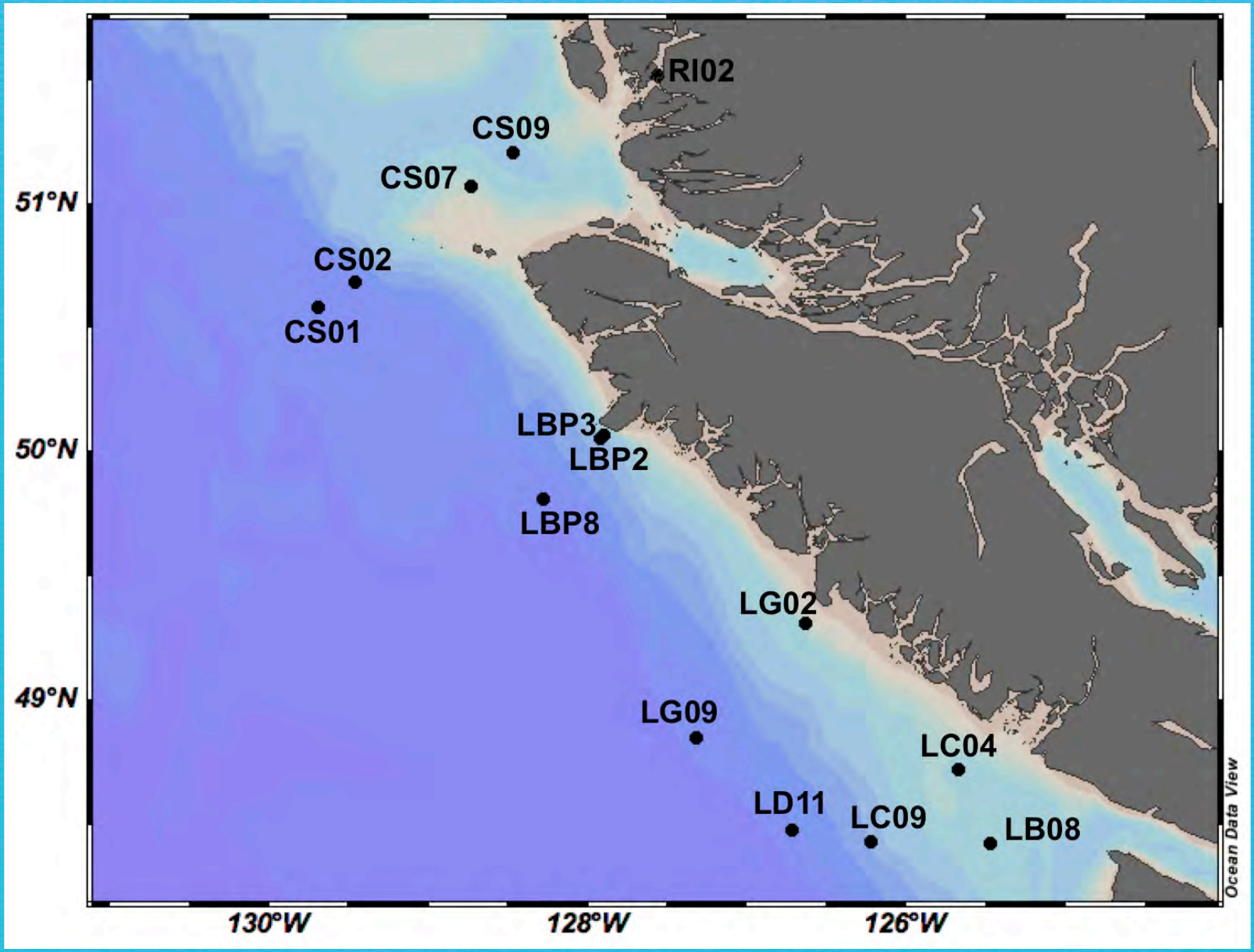
Estimating Energy Transfer

Crustacean BPR

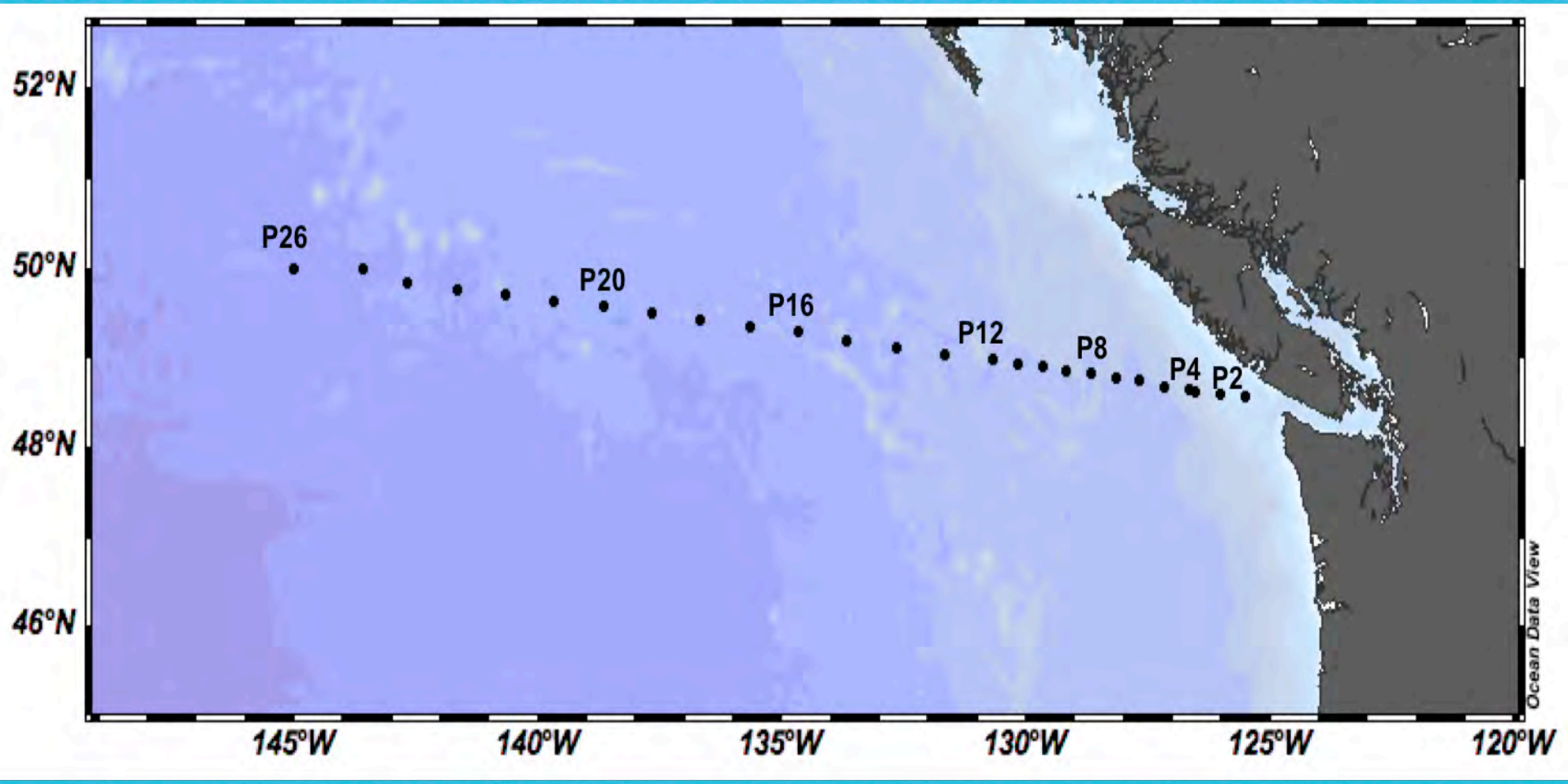
- **Net Community Production (O_2/Ar and N_2O)**
- **^{14}C Primary Production**

Ecological Efficiency

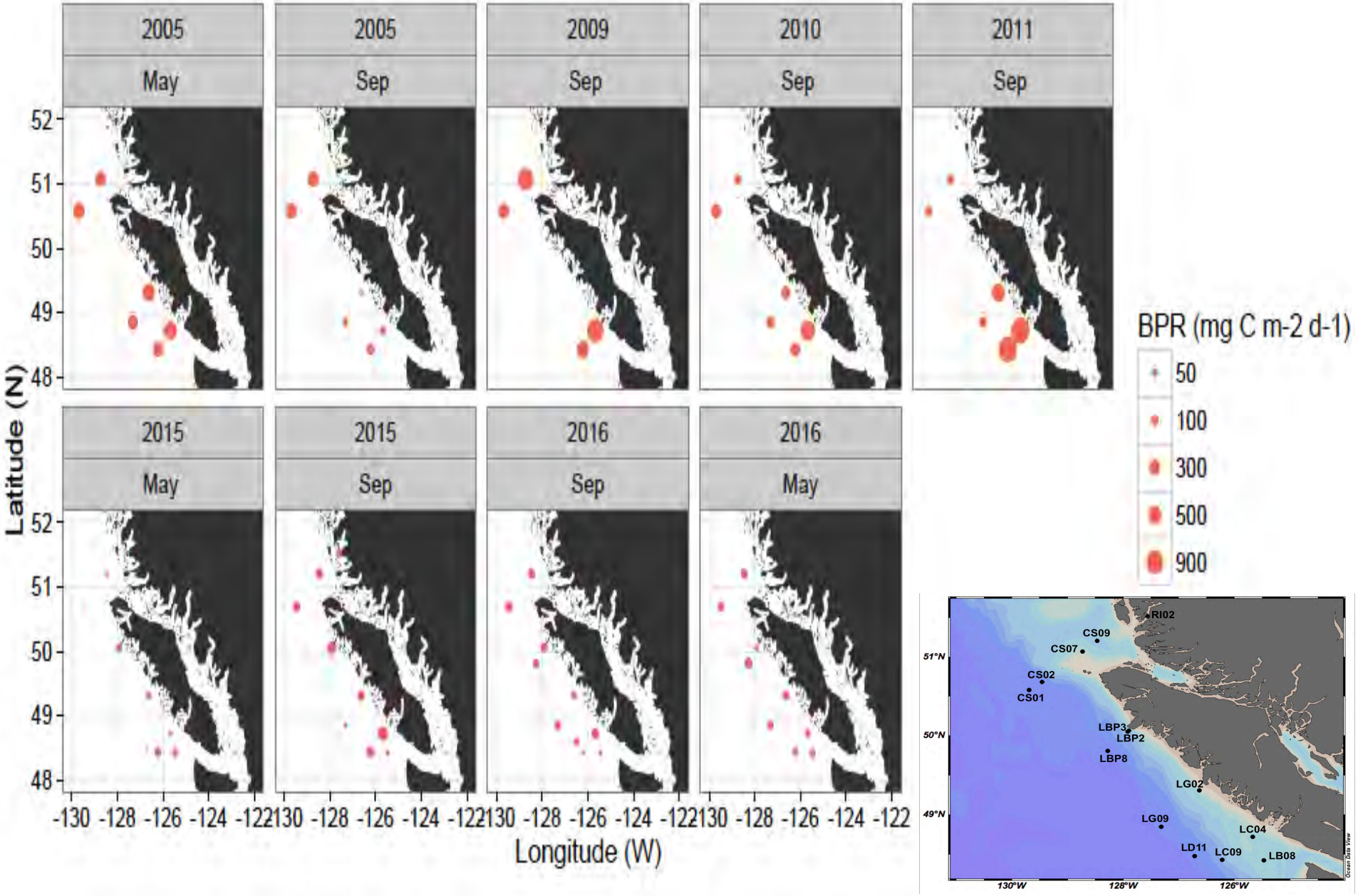
West Coast Vancouver Island (WCVI)



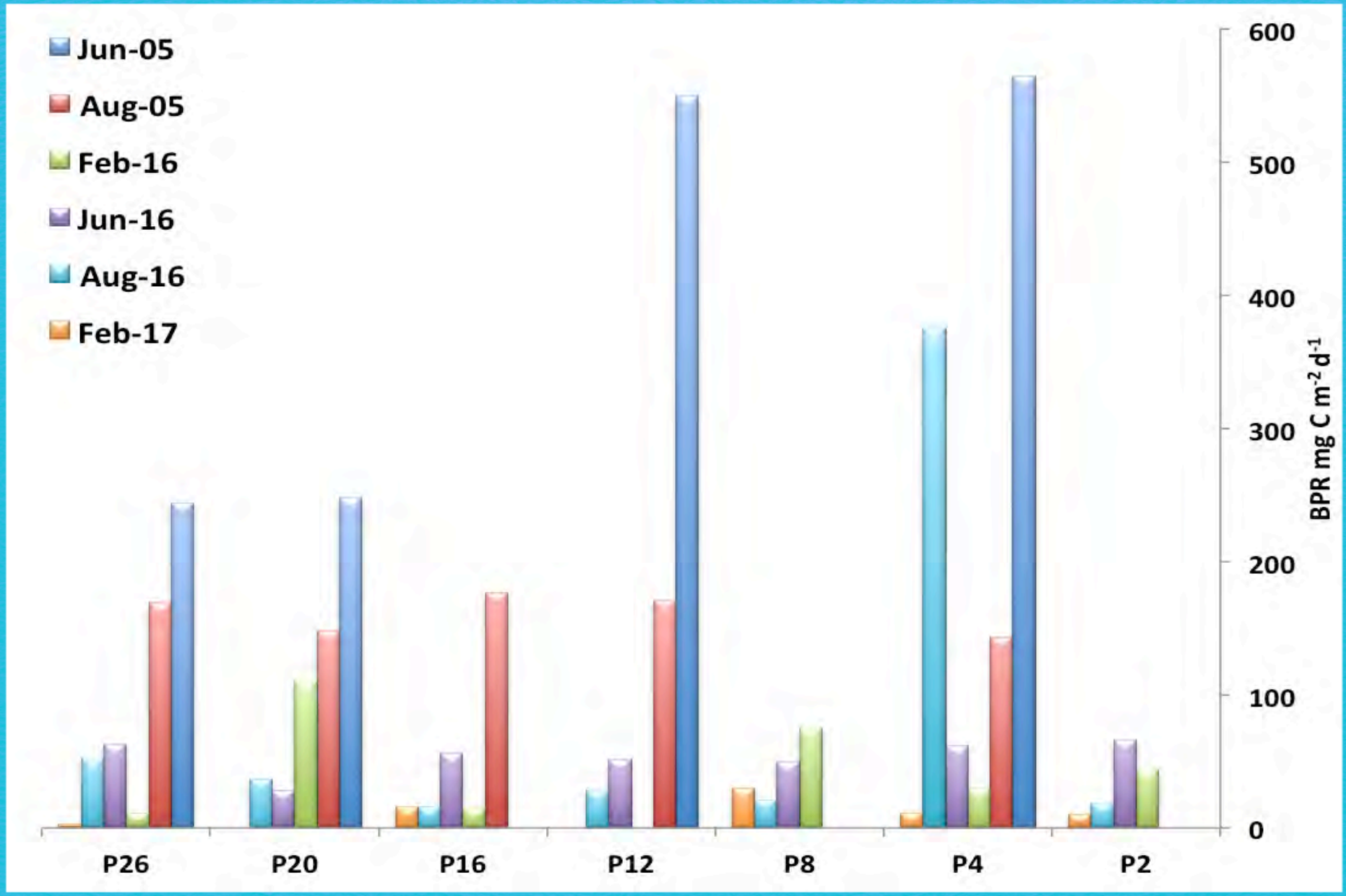
Line P to Ocean Station Papa



BPR for West Coast Vancouver Island



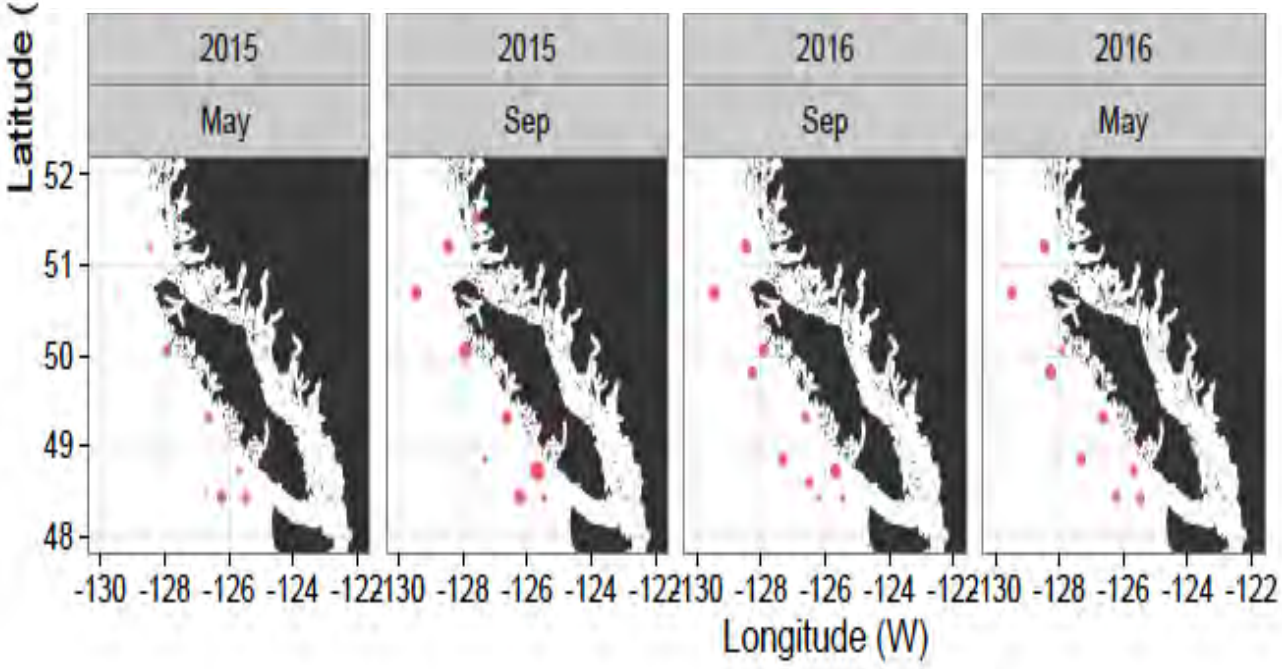
BPR along Line P to Ocean Station Papa

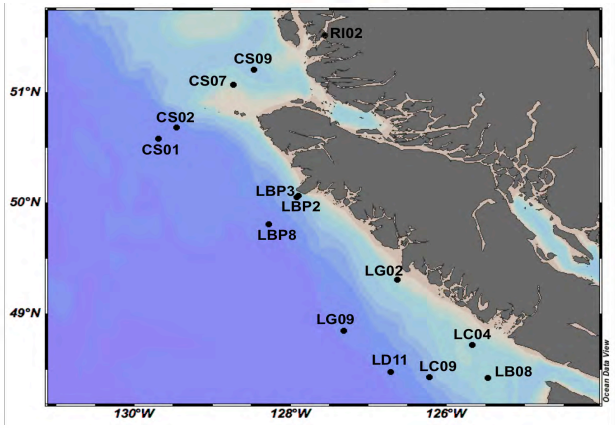


2015 and 2016 Average BPR for WCVI

2015:
May- 32.2 ± 28.5 mg C m^{-2} d^{-1}
September- 108.8 ± 72.8 mg C m^{-2} d^{-1}

2016:
May- 64.6 ± 40.0 mg C m^{-2} d^{-1}
September- 69.5 ± 32.1 mg C m^{-2} d^{-1}





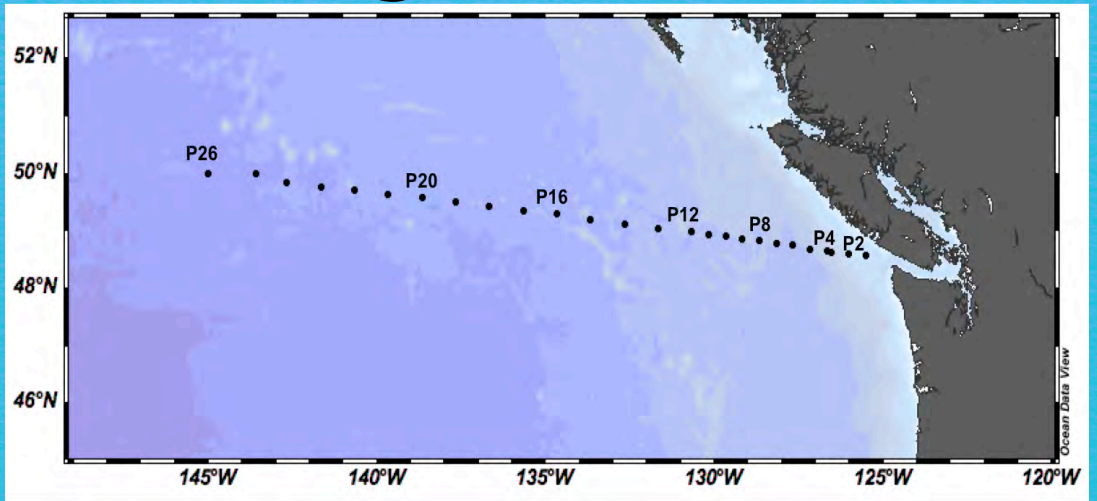
Average BPR along Line P

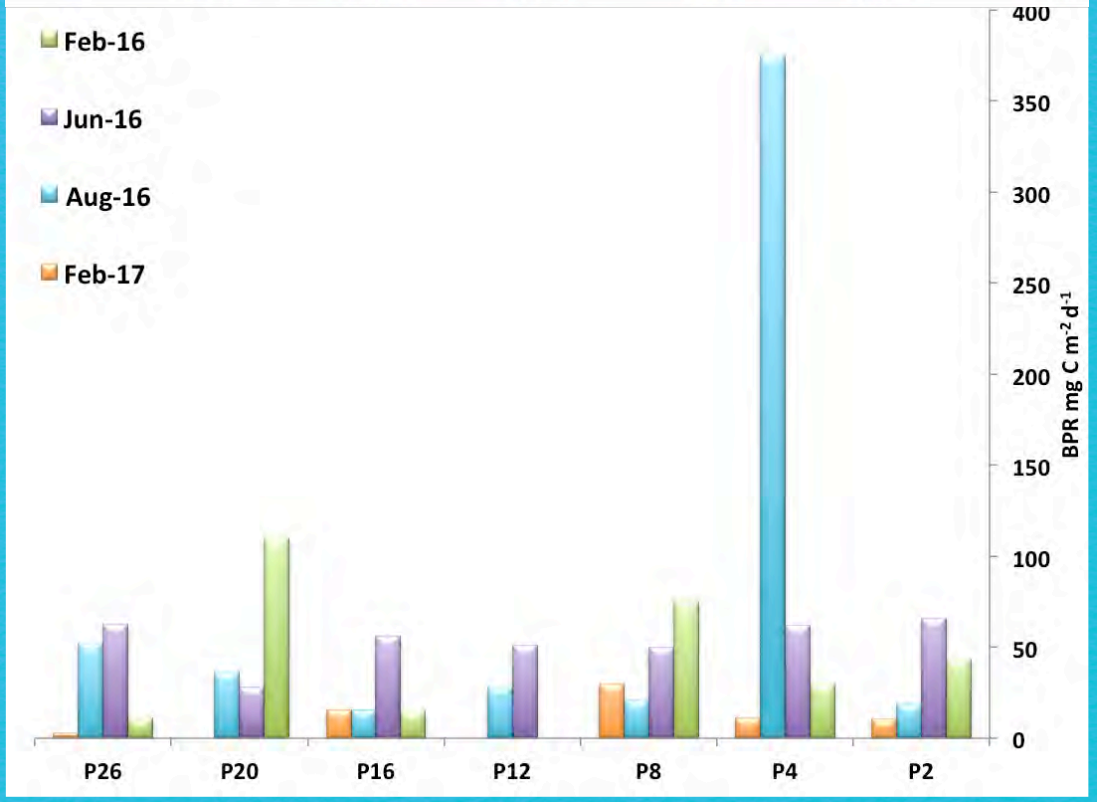
2016:
February-
40.7 ± 39.4 mg C m^{-2} d^{-1}

June-
53.5 ± 12.8 mg C m^{-2} d^{-1}

August-
78.1 ± 131.4 mg C m^{-2} d^{-1}

2017:
February-
10.0 ± 10.6 mg C m^{-2} d^{-1}





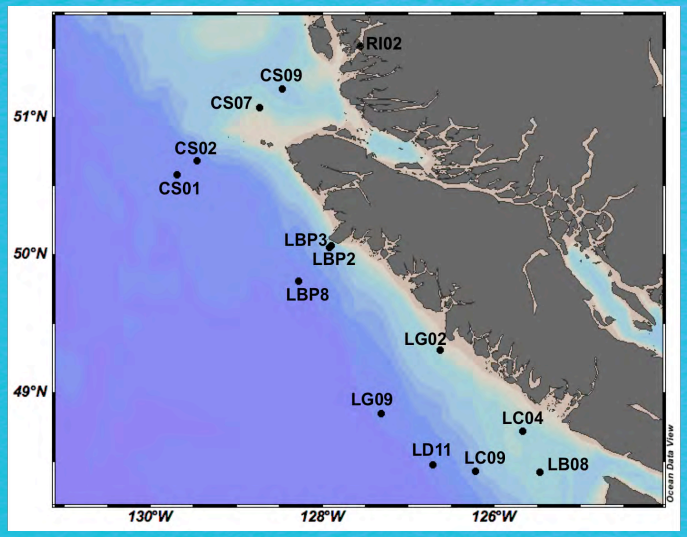
Ecological Efficiencies for WCVI

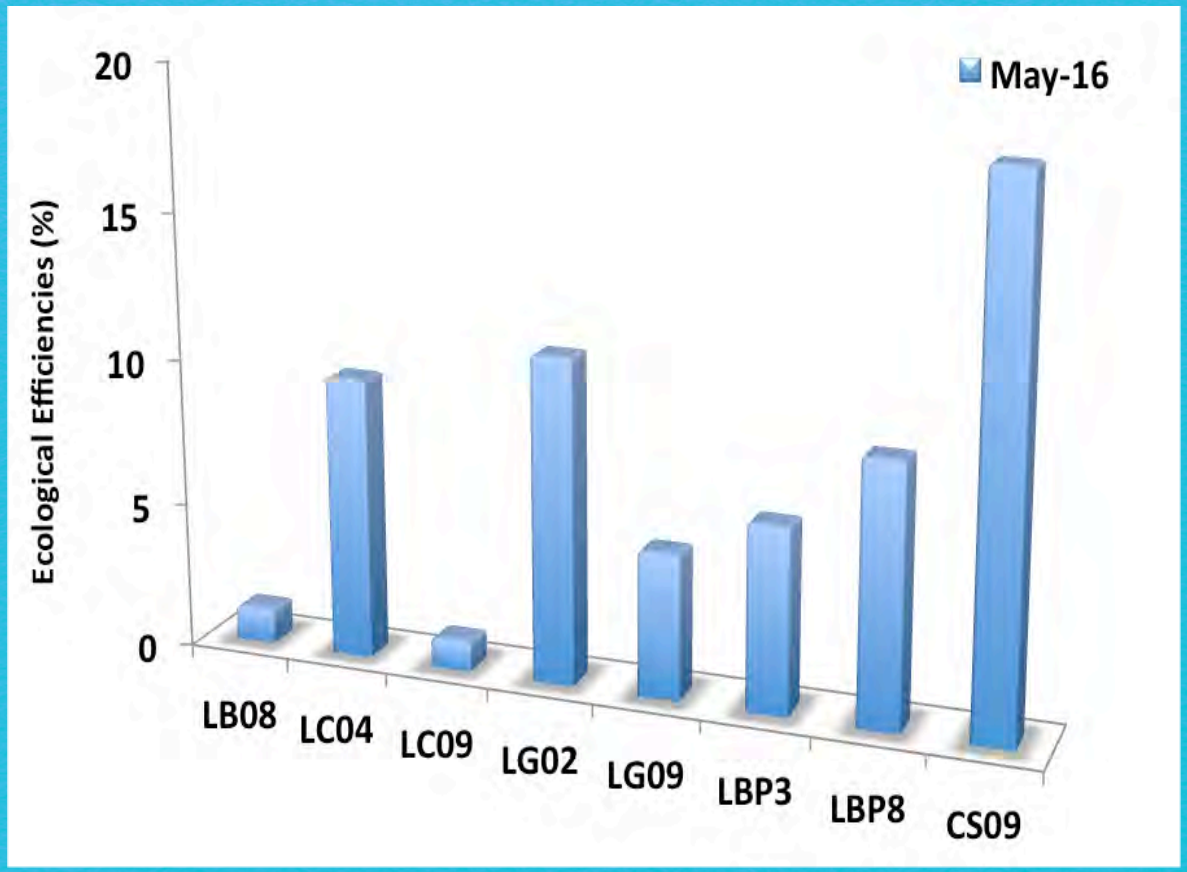
On Shelf Average: 9 %

Off Shelf Average: 5 %

Southern WCVI Average: 6 %

Northern WCVI Average: 11 %



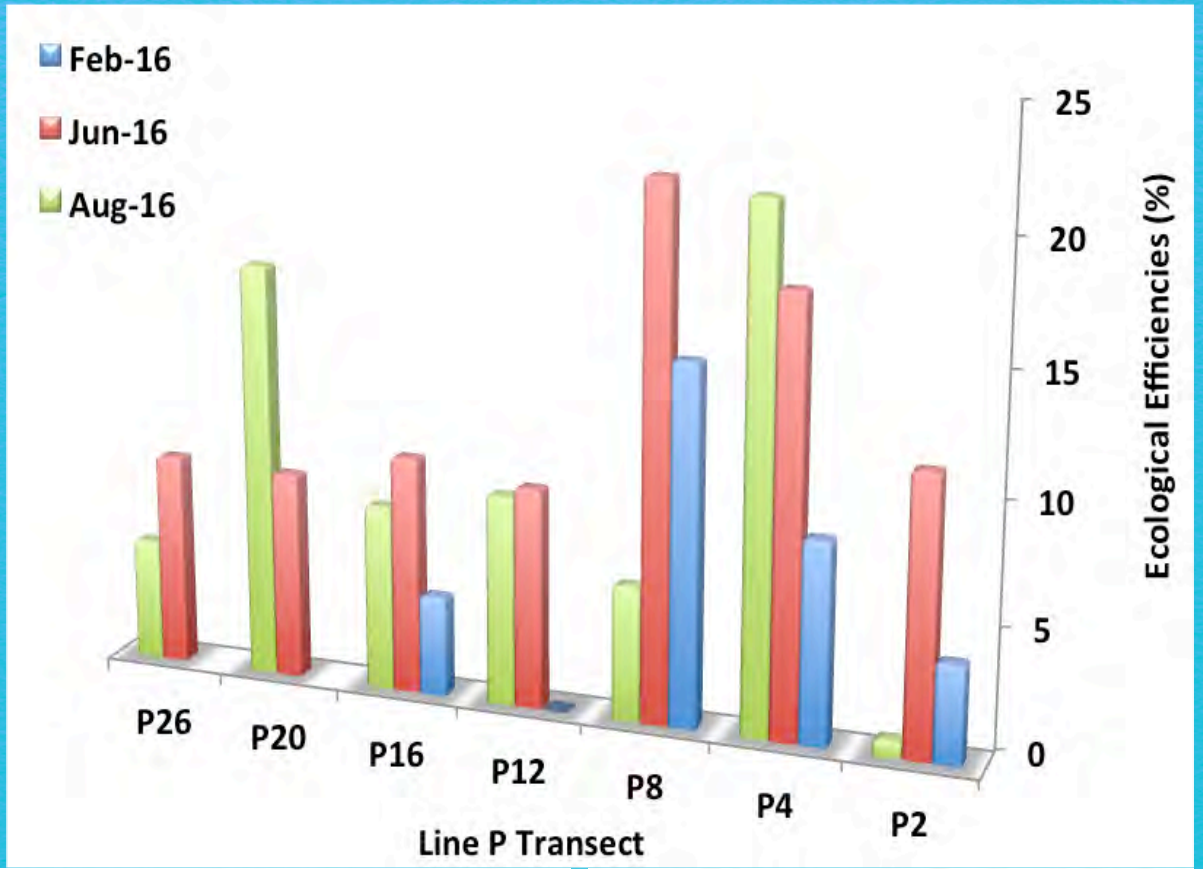


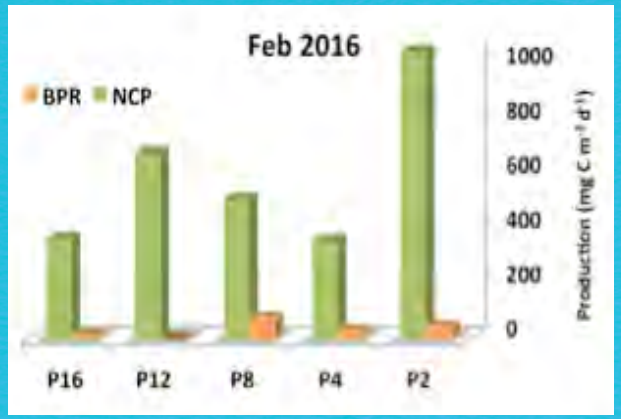
Ecological Efficiencies along Line P

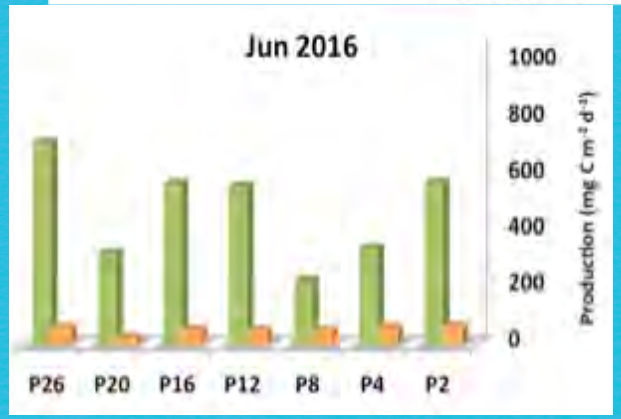
2016

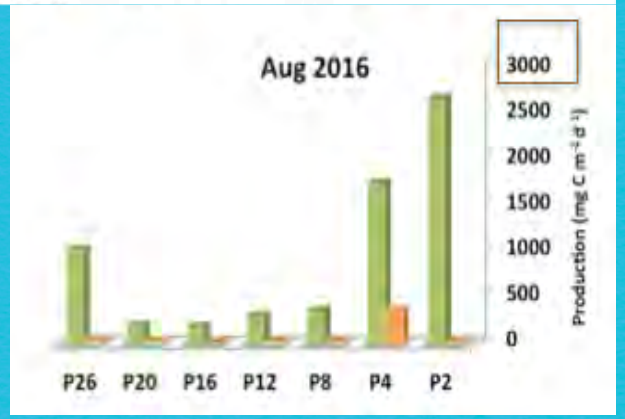
Inshore Average:
February- 6 %
June- 14 %
August- 9 %

Offshore Average:
June- 9 %
August- 11 %







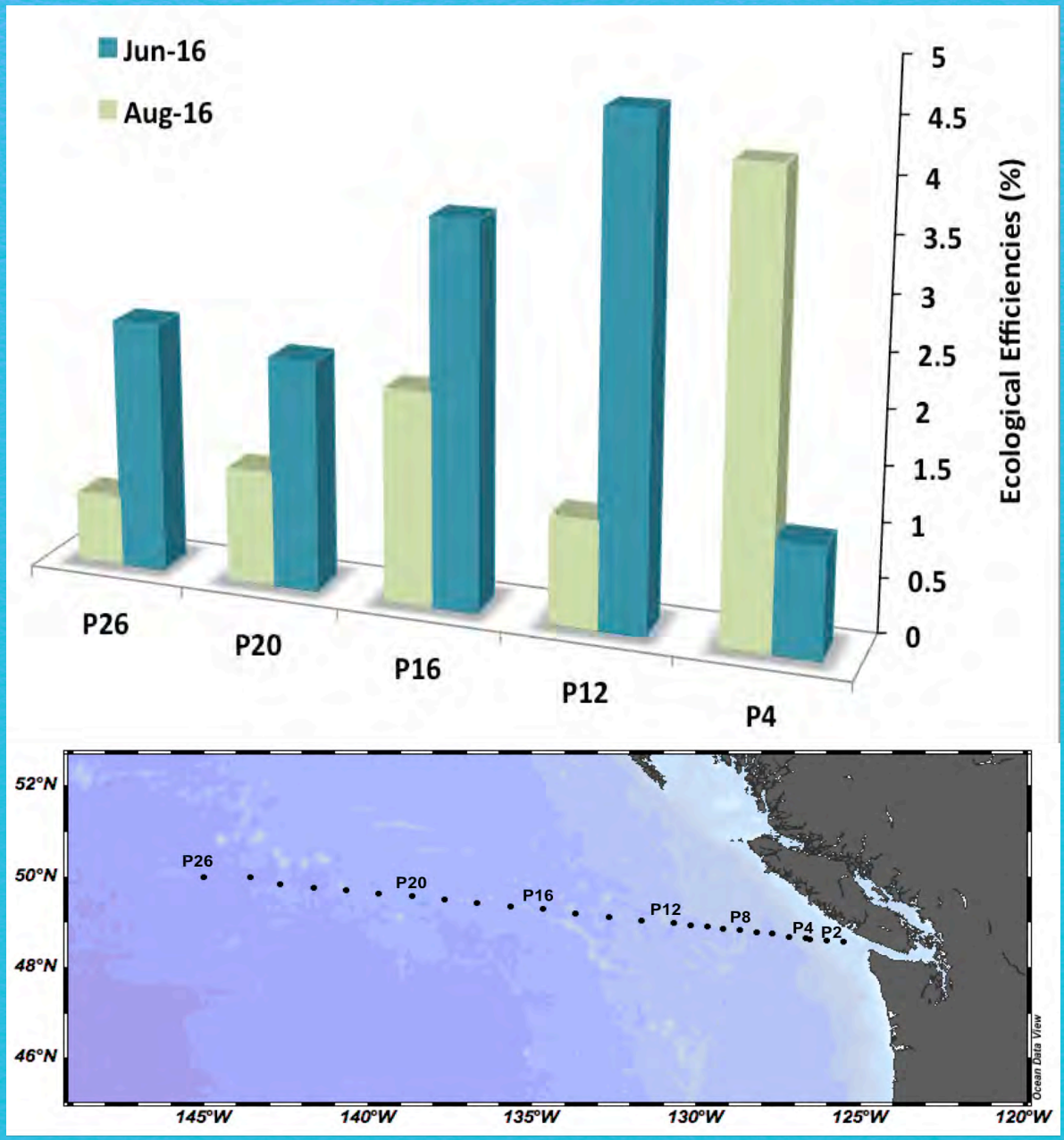


^{14}C and 5m BPR EE along Line P

2016

June:
Inshore- 3 %
Offshore- 2 %

August:
Inshore- 2 %
Offshore- 0.8 %

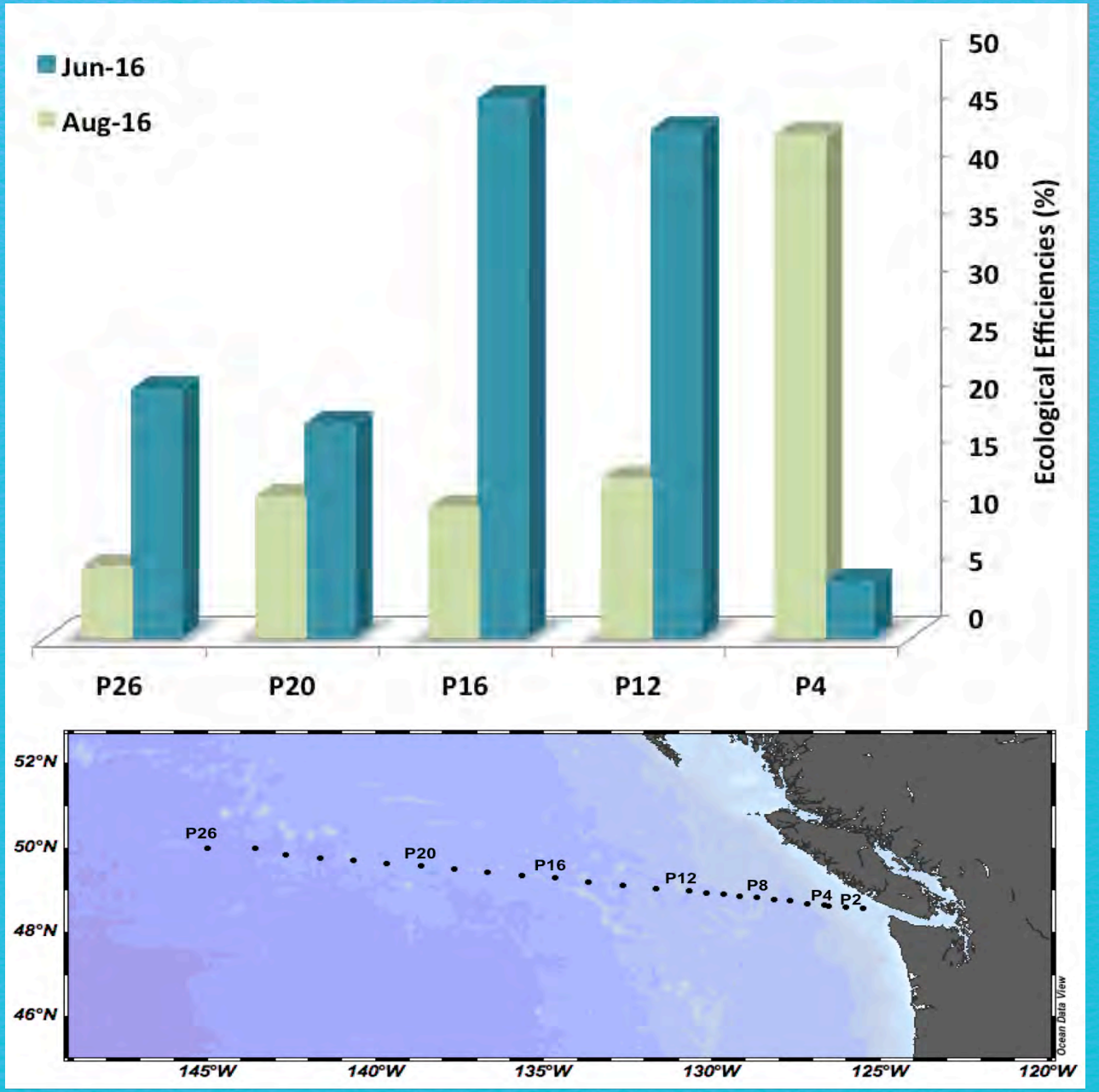


^{14}C and 50m int BPR EE along Line P

2016

June:
Inshore- 32 %
Offshore- 20 %

August:
Inshore- 23 %
Offshore- 9 %



Summary

- Crustacean zooplankton BPR higher in September than May for 2015 off WCVI, no difference in 2016 and in August over June along Line P in 2016
  - Very low compared to previous years
  - More "normal" years May/June is higher than August/September
- Generally higher at stations on the shelf than at off shelf stations
- EE is also higher at on shelf stations off WCVI
- EE at southern WCVI stations lower than northern WCVI
- EE at inshore stations along Line P highest in June, but highest in August at offshore stations