Effects of out-migration size and timing on early marine survival of Chinook salmon in the ocean

Brian Wells
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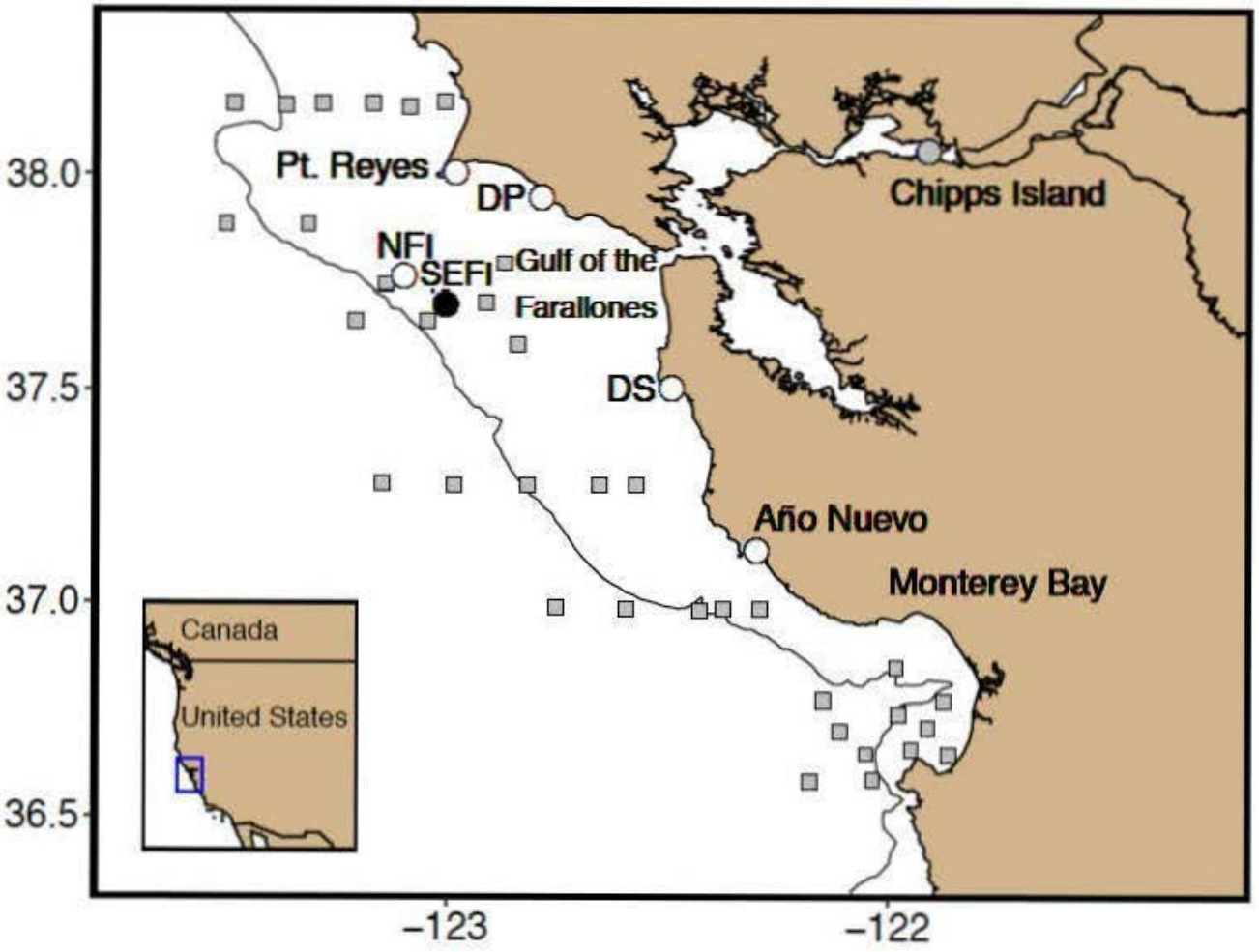
Region of interest



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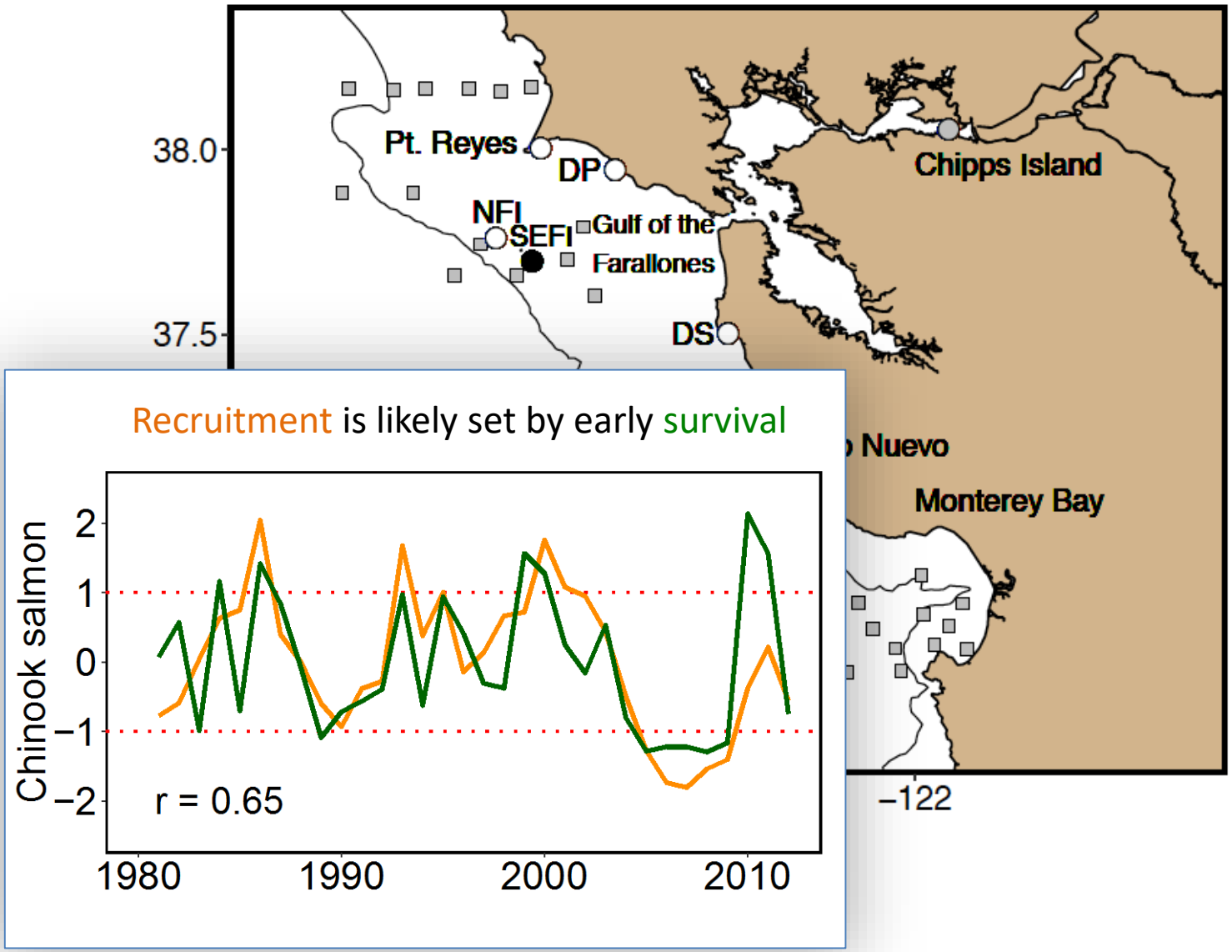

Overview

- Timing of emigration relates to survival
- Survival can be size selective
- Survival and growth increase with developed forage
- Seabird predation has significant impact of juvenile salmon survival

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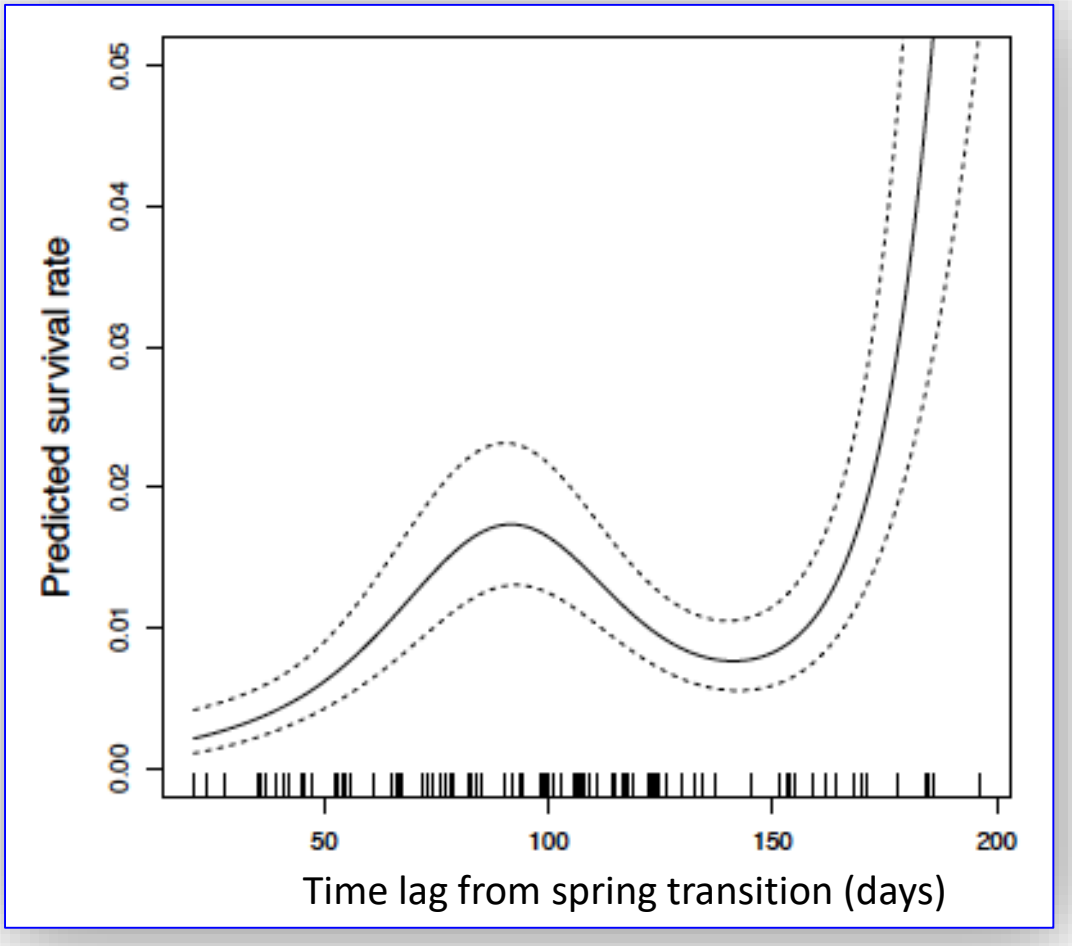

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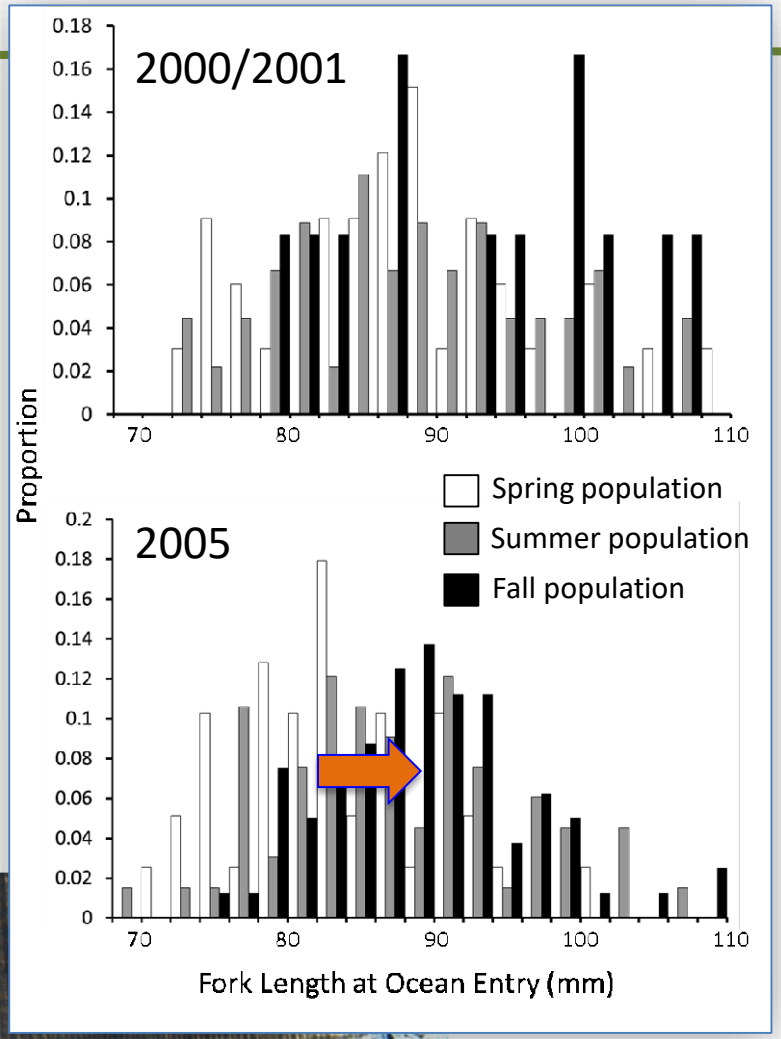
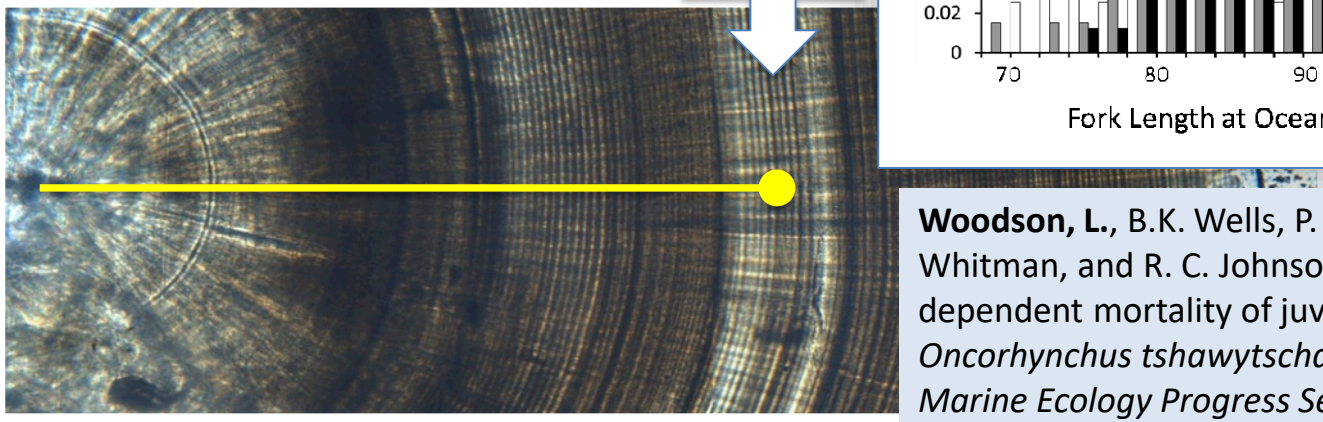
Size-selective mortality

A shift in the mean and distribution of retrospective sizes at ocean entry informed us about the level of selective mortality during good and bad year.





Woodson, L., B.K. Wells, P. Weber, R.B. MacFarlane, G Whitman, and R. C. Johnson. 2013. Growth, size, and origin-dependent mortality of juvenile Chinook salmon *Oncorhynchus tshawytscha* during early ocean residence. *Marine Ecology Progress Series*. 487:163-175.

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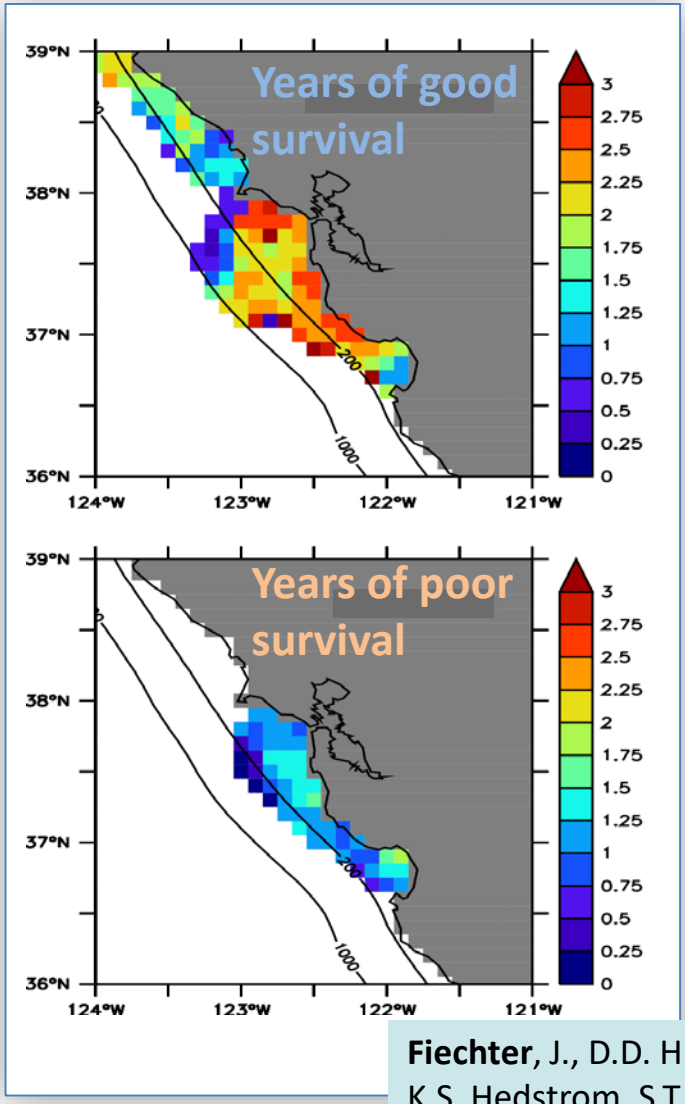
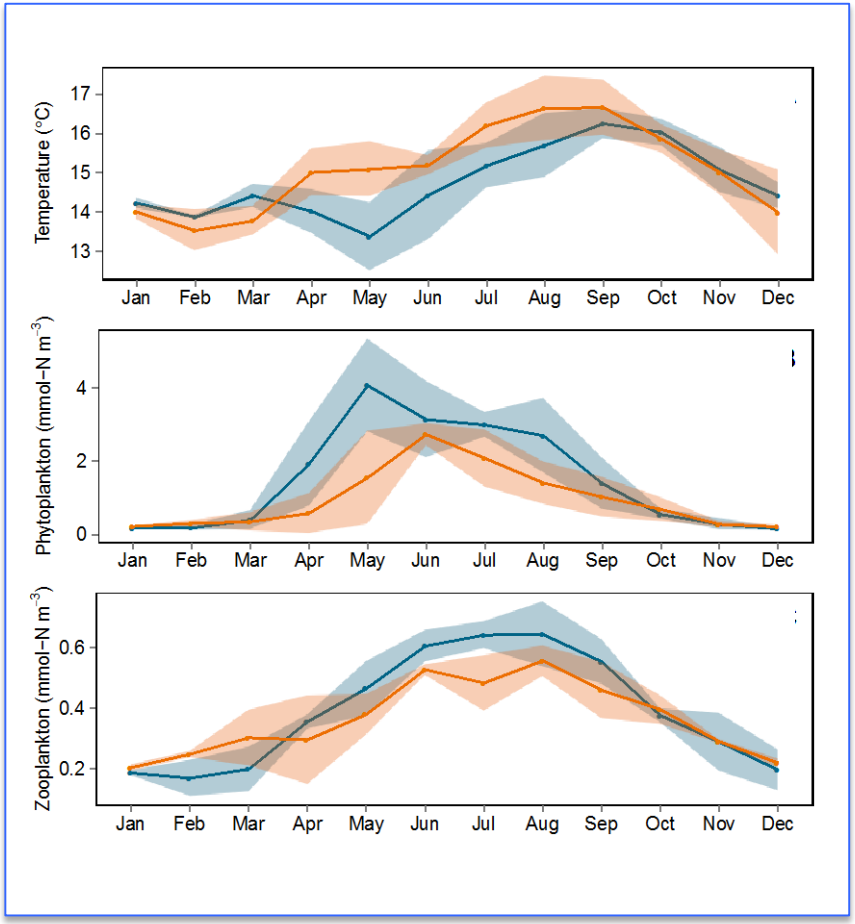
Survival is increased when the forage base is developed (*timing*)





Fiechter, J., D.D. Huff, B.T. Martin, D. Jackson, C.A. Edwards, K.A. Rose, E.N. Curchitser, K.S. Hedstrom, S.T. Lindley, and B.K. Wells. 2015. Environmental conditions impacting juvenile Chinook salmon growth off central California: an ecosystem model analysis. *Geophysical Research Letters*. 42:2910-2917

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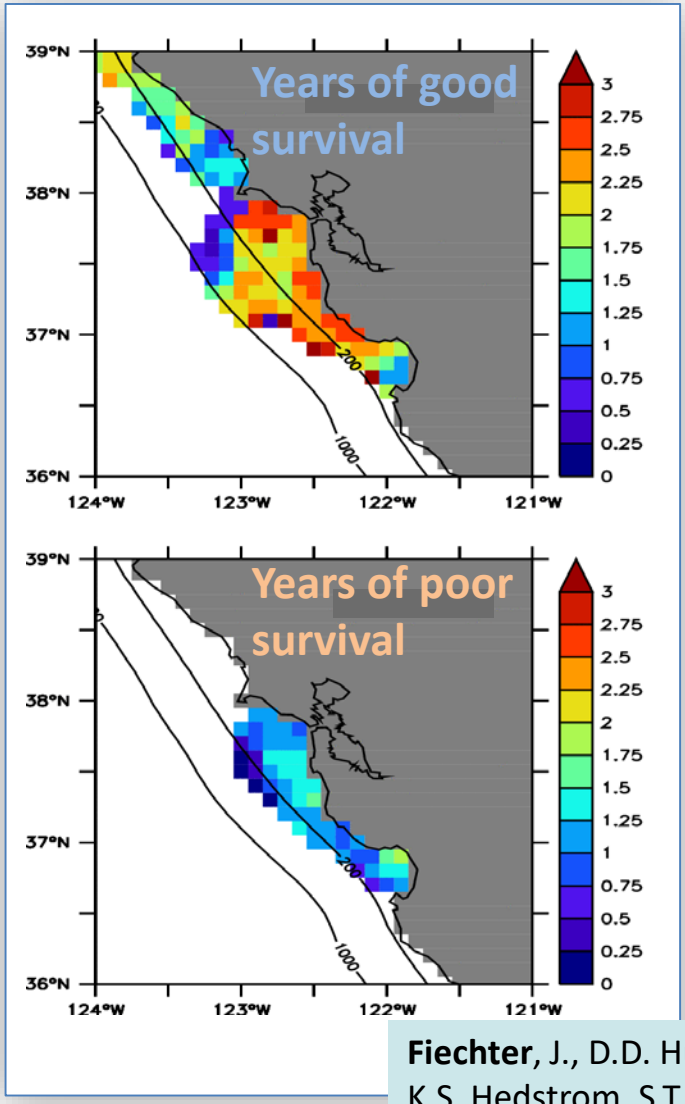

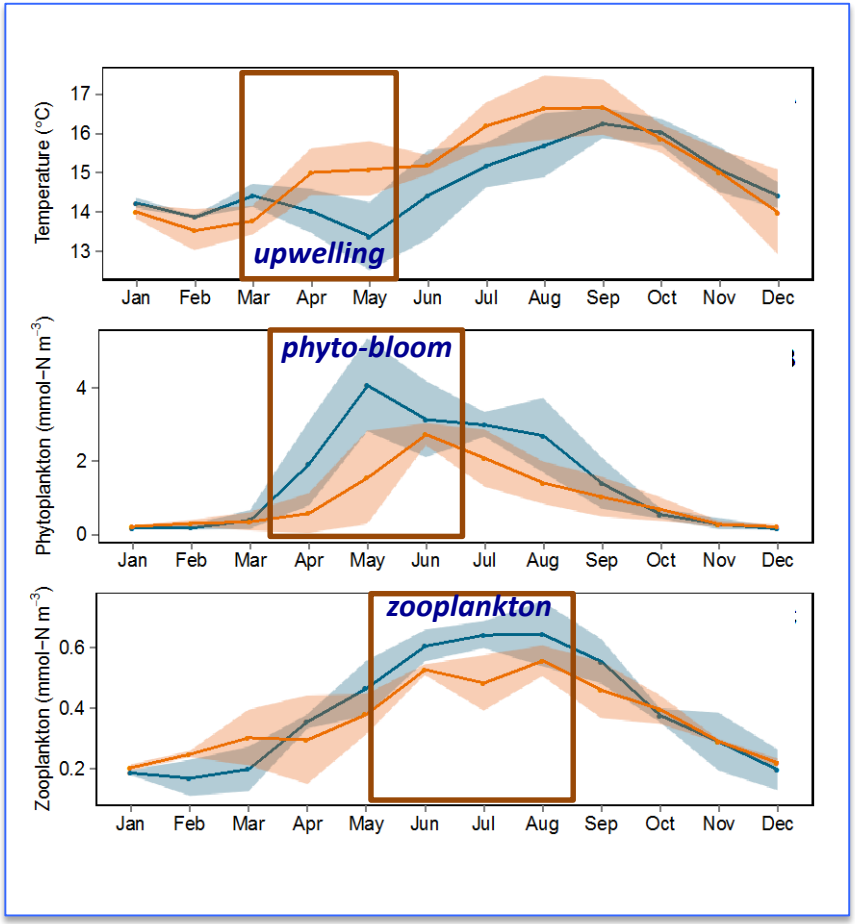

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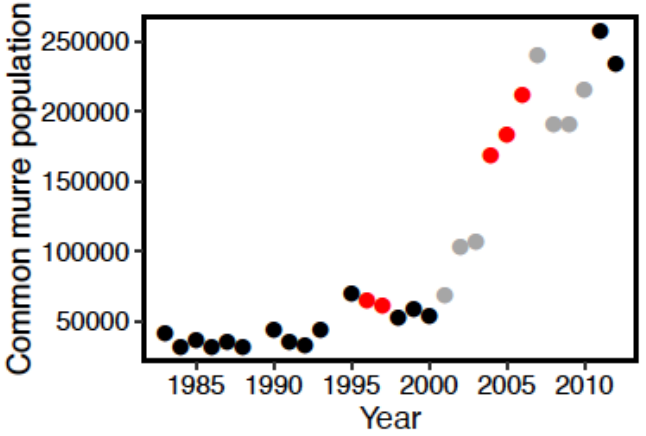
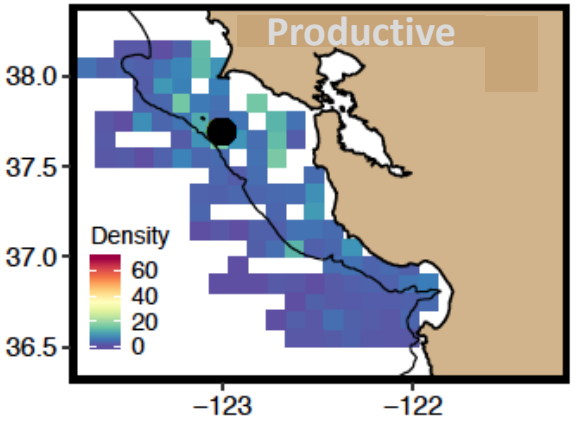
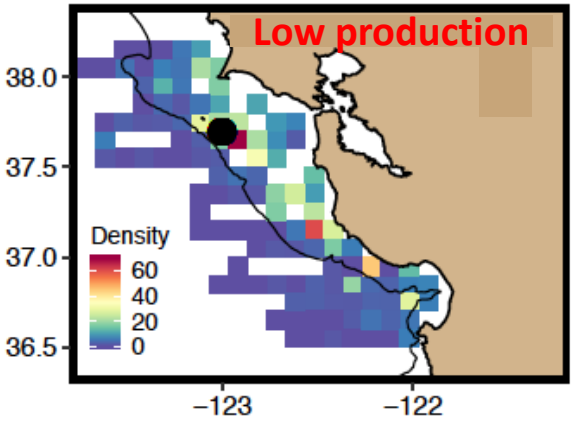
Seabird predation has impact of juvenile salmon survival (*size-selection*)

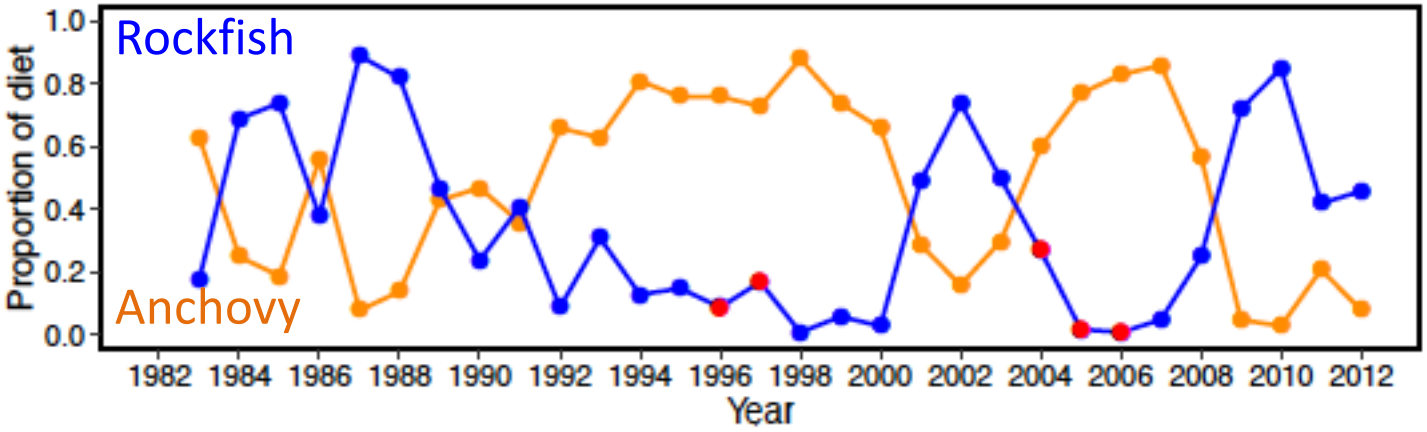
Common murre move inshore in dense aggregations during **low-production** years relative to **productive** years.



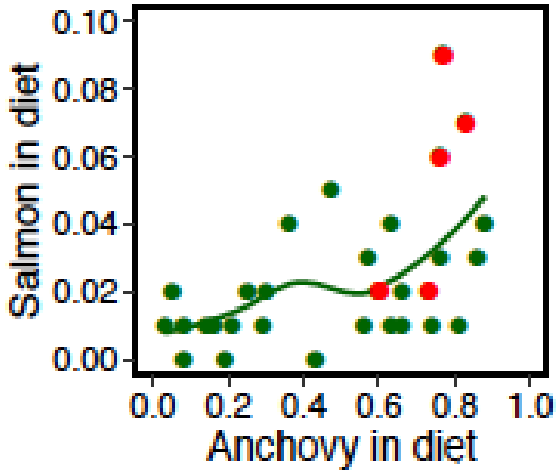




Seabird predation has impact of juvenile salmon survival (*size-selection*)



More salmon are preyed on when anchovy are the predominant prey

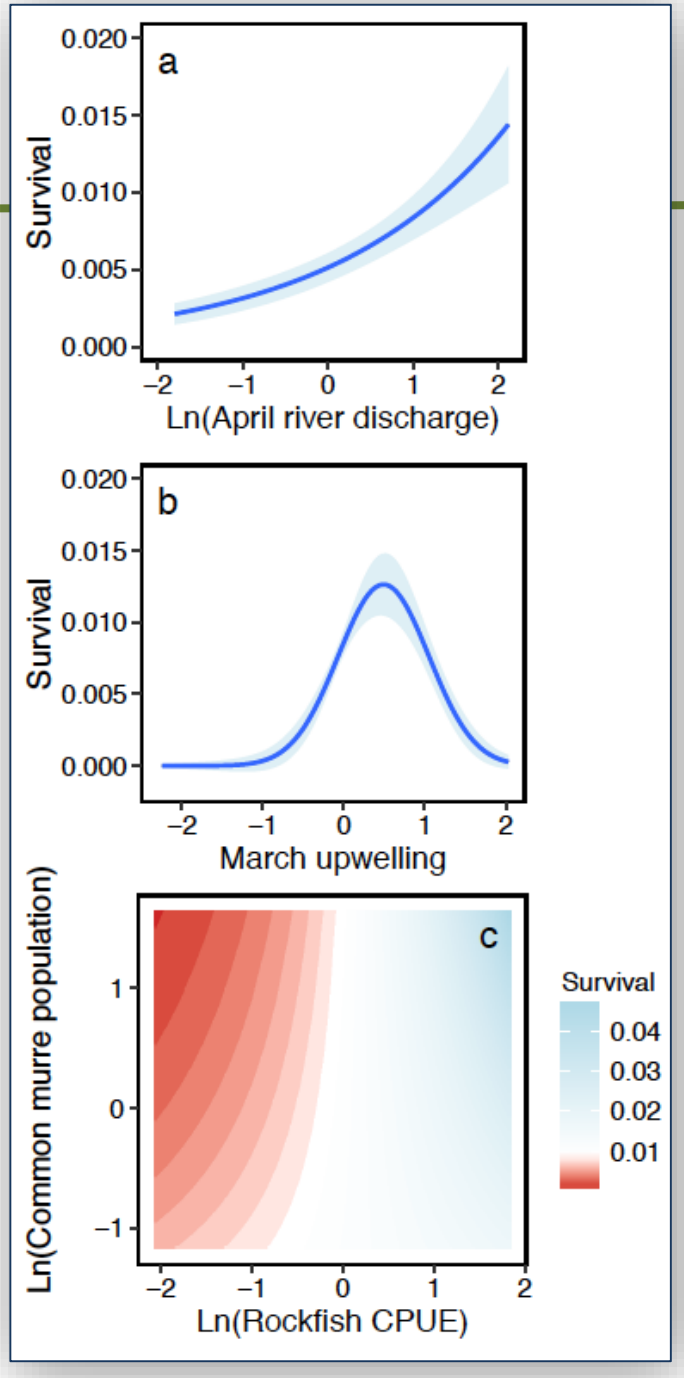


Combining predation, forage and environment

A combined model shows that survival relates to freshwater and oceanographic conditions

And

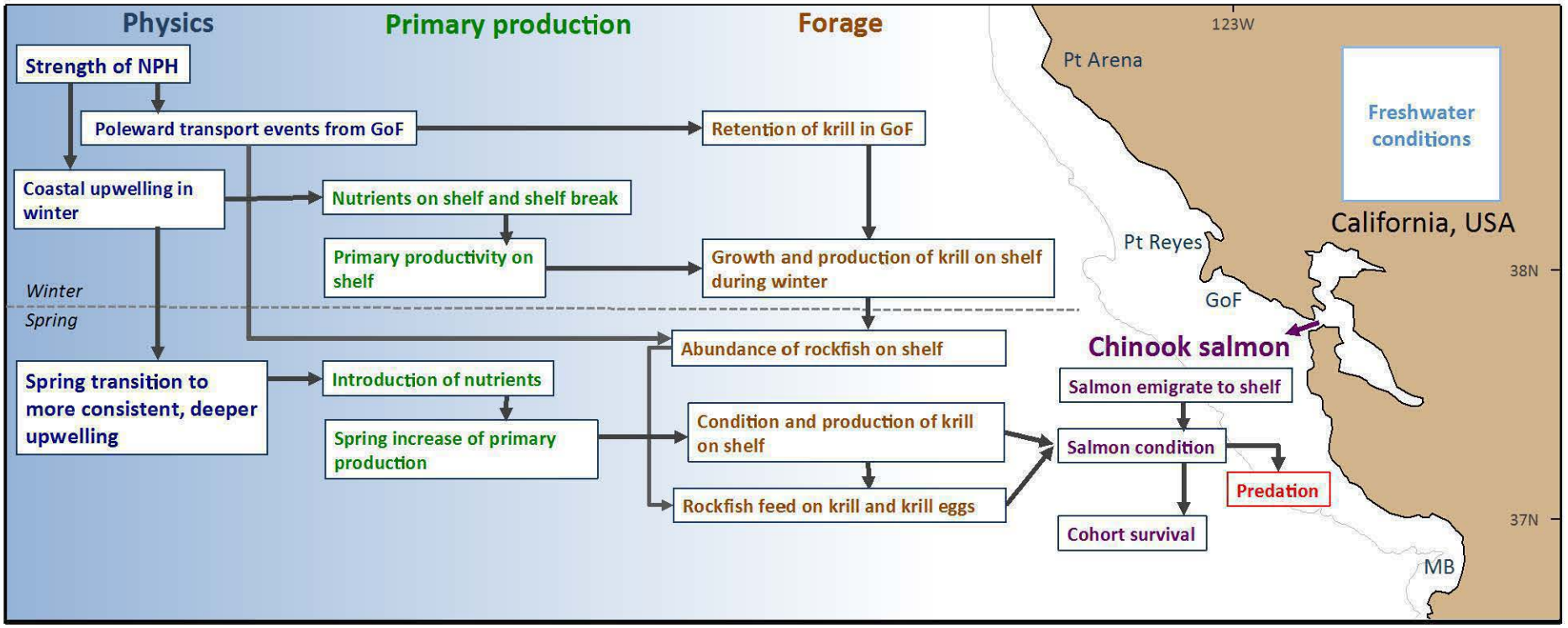
The interaction between murre and rockfish demonstrates that if rockfish falls below median abundance, common murre can have a dramatic affect on salmon survival



Conclusions

- Emigrating ~100 days following initial upwelling is beneficial
- Survival can be size selective during poor productivity years
- Survival and growth increase with developed forage
- Seabirds, during reduced forage conditions, switch to salmon
- These dynamics are set in the context of spatio-temporal variability

Ocean survival is the result of complex spatio-temporal variability and *freshwater conditions can setup success* but we *need to understand the mechanisms* to develop the most effective freshwater management strategies.



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