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S1: Science Board Symposium

Future projected impacts of ocean warming to potential squid habitat in the North Pacific

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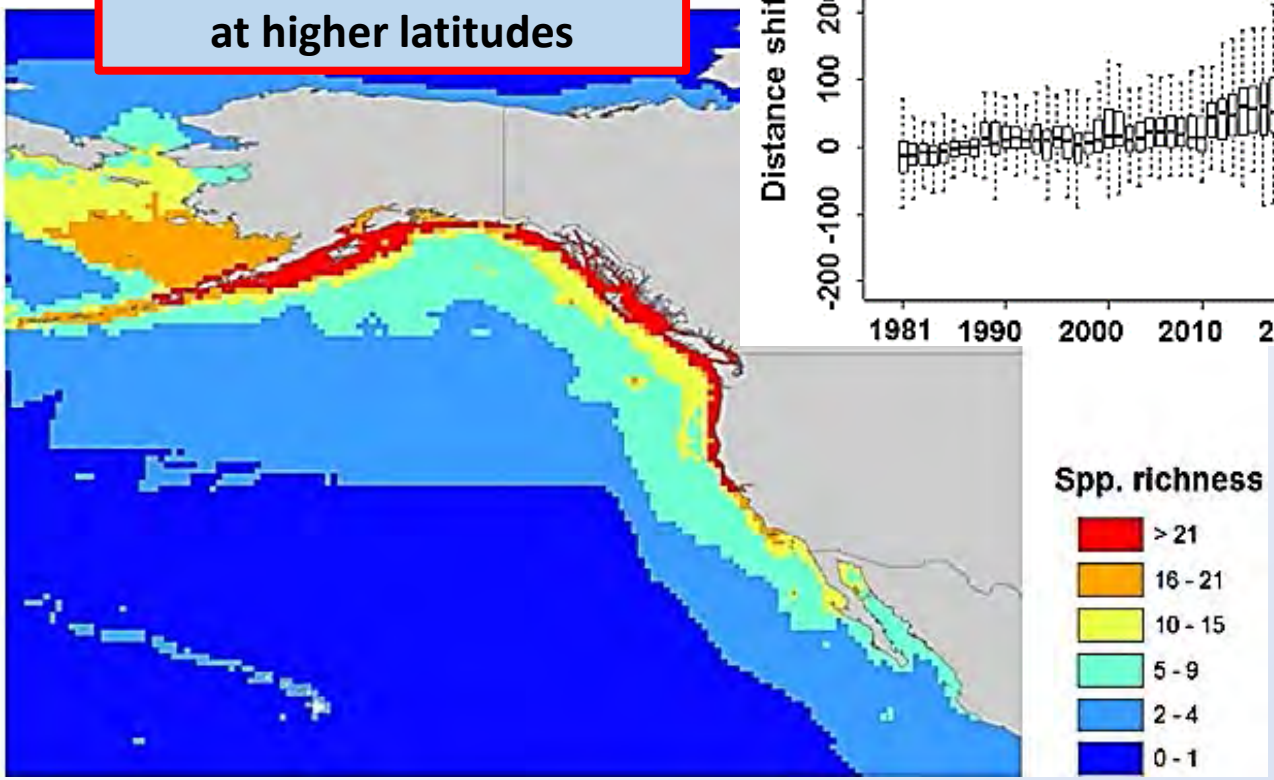
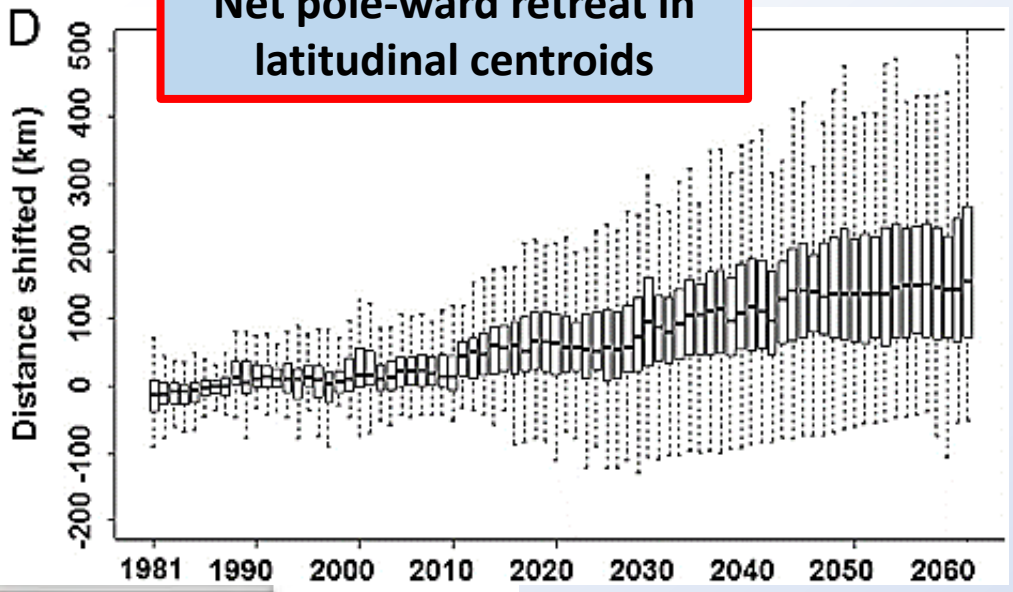
Research Program on Climate Change Adaptation

Introduction: Climate-driven changes in marine biodiversity

Net pole-ward retreat in latitudinal centroids

Increase in species richness at higher latitudes

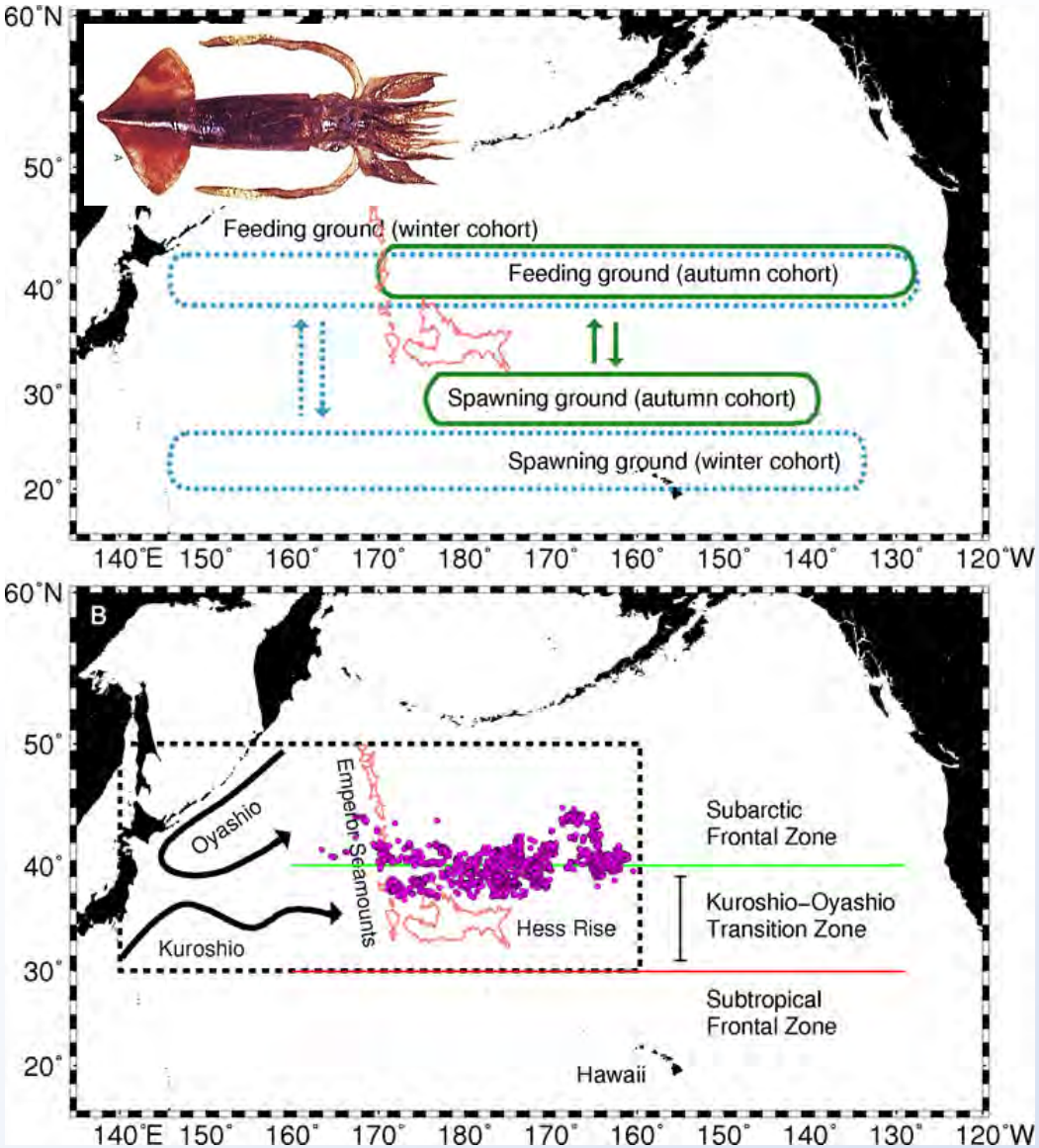




Warming climate drives the changes in species abundance and distribution.

Cheung et al. 2014

Introduction: Squid as biological proxy of climate changes



North Pacific population is comprised of 2 seasonal spawning cohorts (winter-spring and autumn) – Yatsu et al. 1997, 1998; Bower & Ichii 2005; Ichii et al. 2009

Responds quickly to the changes in the environment

Squid fishery occurs off a highly dynamic region (e.g. major currents & frontal systems) – Roden 1991; Talley et al. 1995; Yasuda et al. 2003; Polovina et al. 2006

Introduction: research rationale

Objective

Examine the squid potential habitat distribution patterns in response to future ocean warming and quantify its regional impact in the North Pacific

Significance of the study

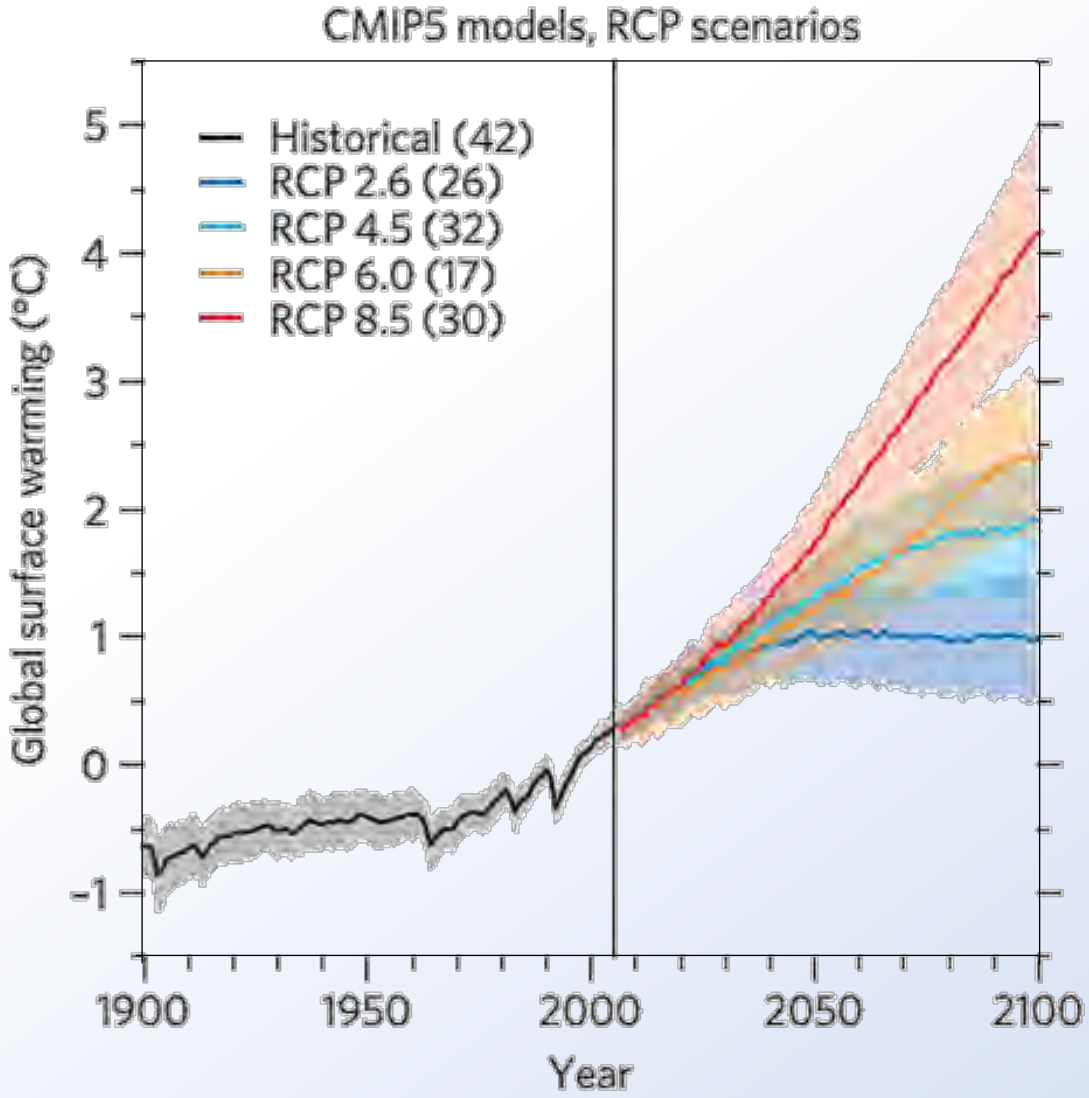
- Baseline understanding of squid habitat responses to ocean warming
- Relevant insights to inform decisions amongst resource stakeholders

Data & Methods

Environmental variables	Source	Temporal Resolution	Source Resolution	Model AUC Contribution
Sea surface temperature	AVHRR-OI	monthly	25 km	0.8697
Sea surface salinity	MOVE-MRI	monthly	10 km	0.8203
Sea surface height	AVISO	monthly	25 km	0.8286
Net Primary Production	OSU	monthly	9 km	0.7501
Squid fishing locations	APITRC	monthly	May-July 2000-2010	
IPCC-5 Models	**Country**			**Scenarios[5]**
[1]MIROC-ESM	Japan	monthly	0.2°x0.3°	RCP4.5 RCP6.0 RCP8.5
[2]CSIRO MK3.6	Australia	monthly	0.8°x1.9°	
[3]GFDL CM3.0	USA	monthly	0.3-1.0°x1.0°	
[4]HadGEM2ES	UK	monthly	0.3-1.0°x1.0°	

[1]Watanabe et al. 2011; [2]Rotstayn et al. 2012; [3]Donner et al. 2011; [4]Jones et al. 2011; [5]van Vuuren et al. 2011

Data & Methods: Attributes of IPCC CMIP5 model scenarios



Knutti & Sedlacek 2013

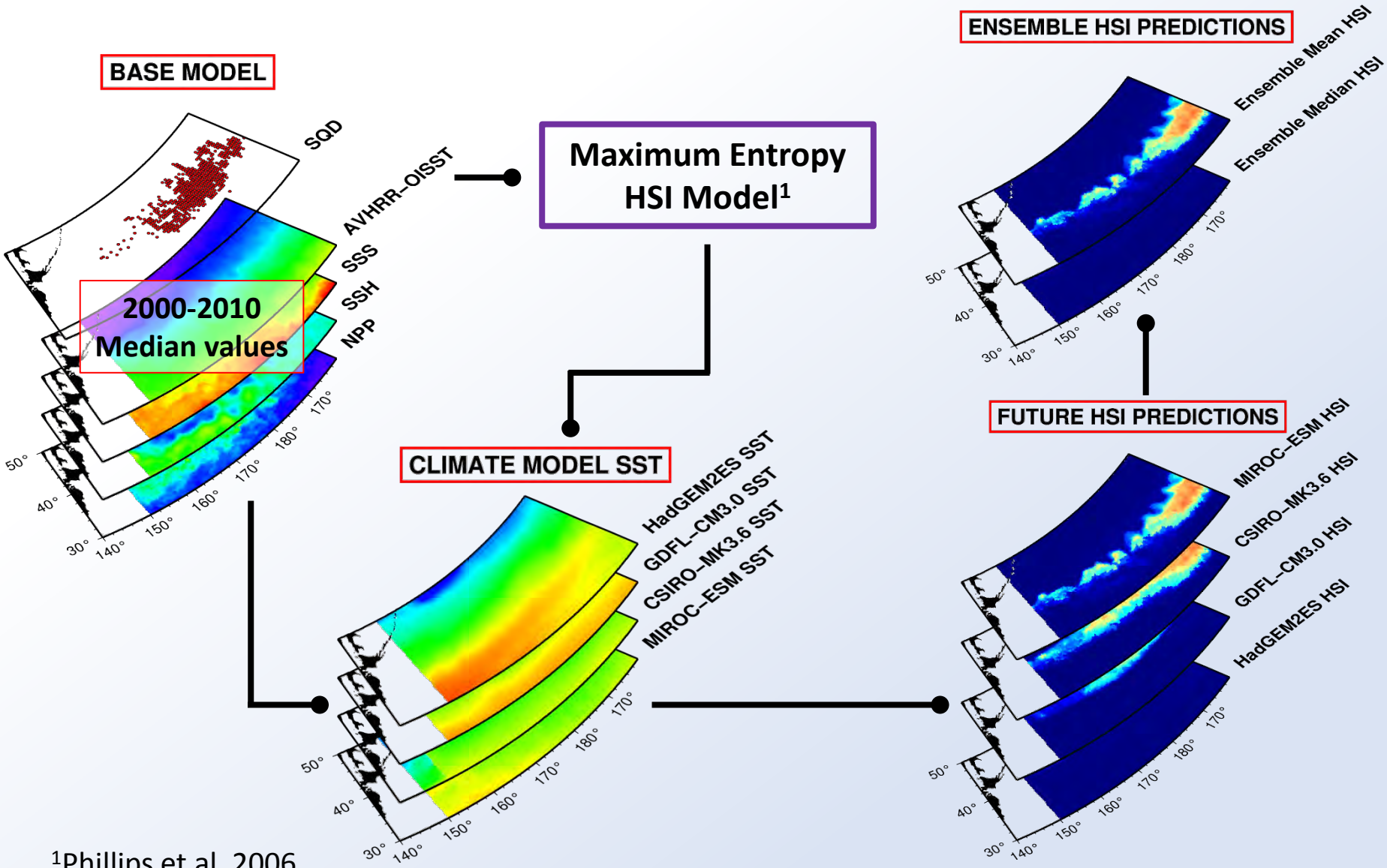
RCP 8.5: Rising emissions throughout the 21st century

RCP 6.0: Peak emissions around 2080, then decline

RCP 4.5: Peak emissions around 2040, then decline

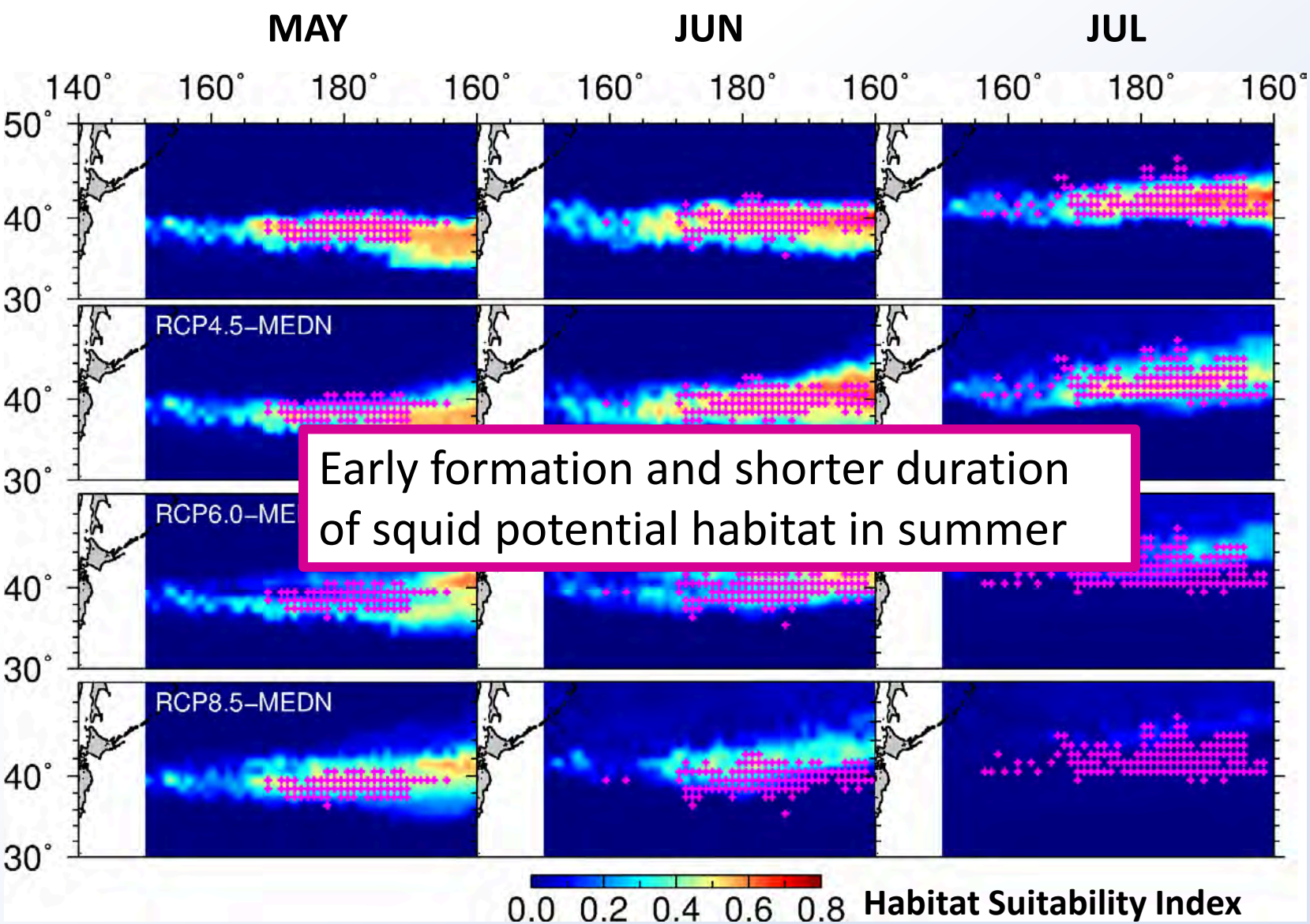
Meinshausen et al. 2011

Data & Methods: habitat model framework

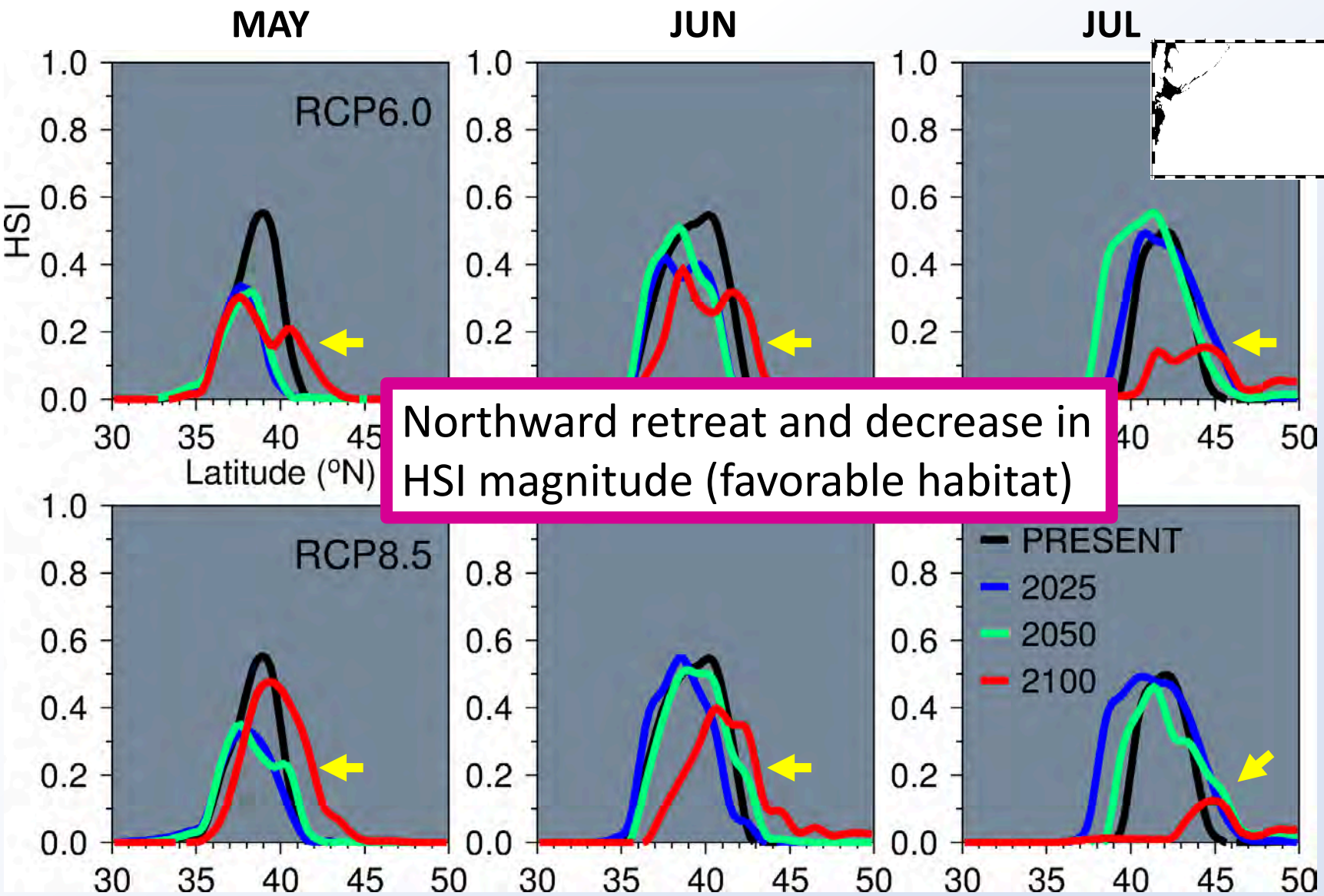


[1]Phillips et al. 2006

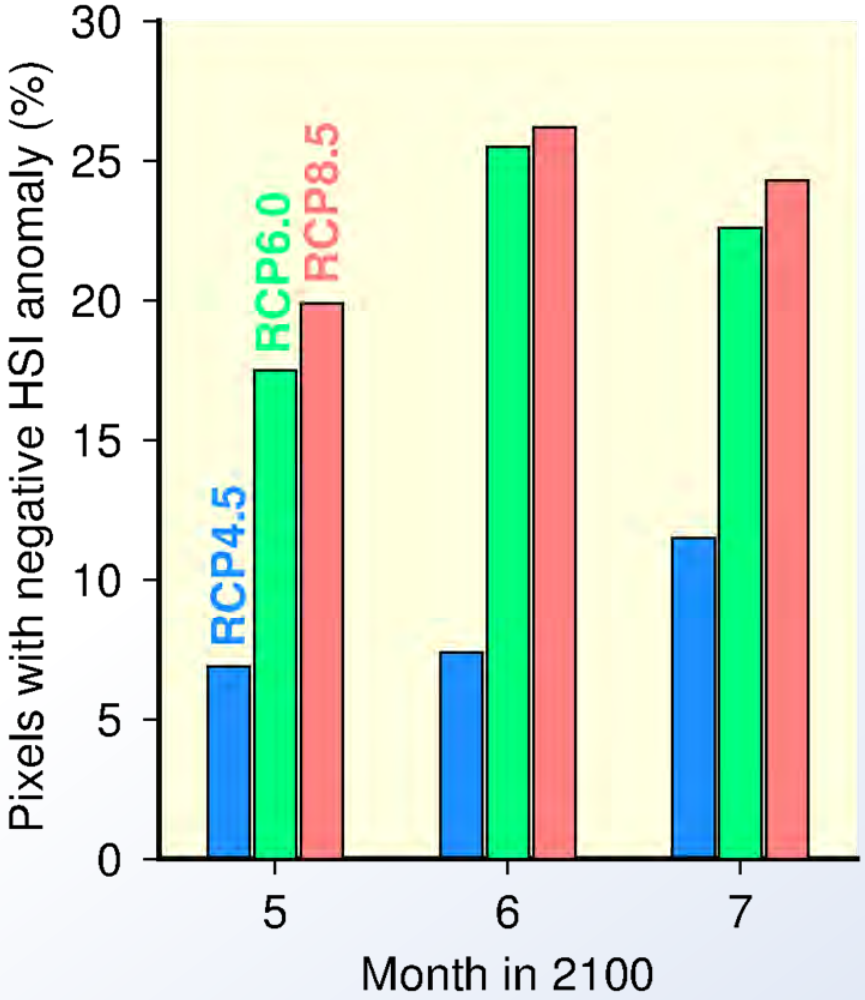
Results & Discussion: Squid habitat in the late century (2100)

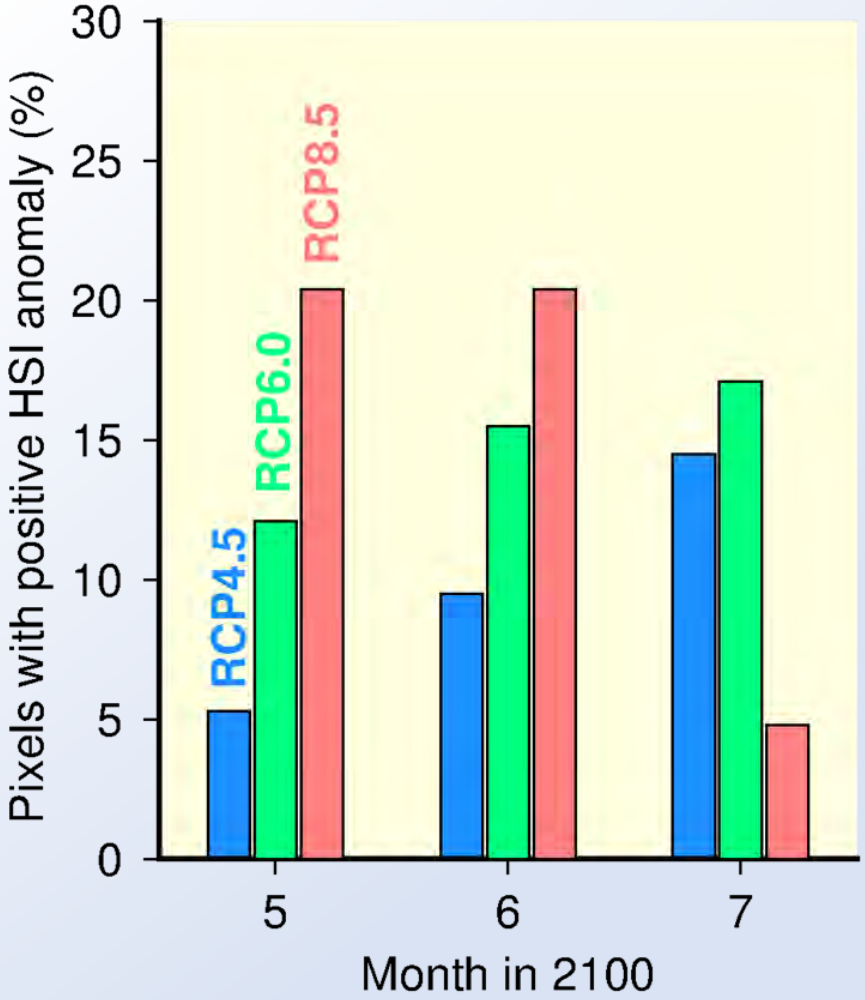


Results & Discussion: Latitudinal shift in potential habitat



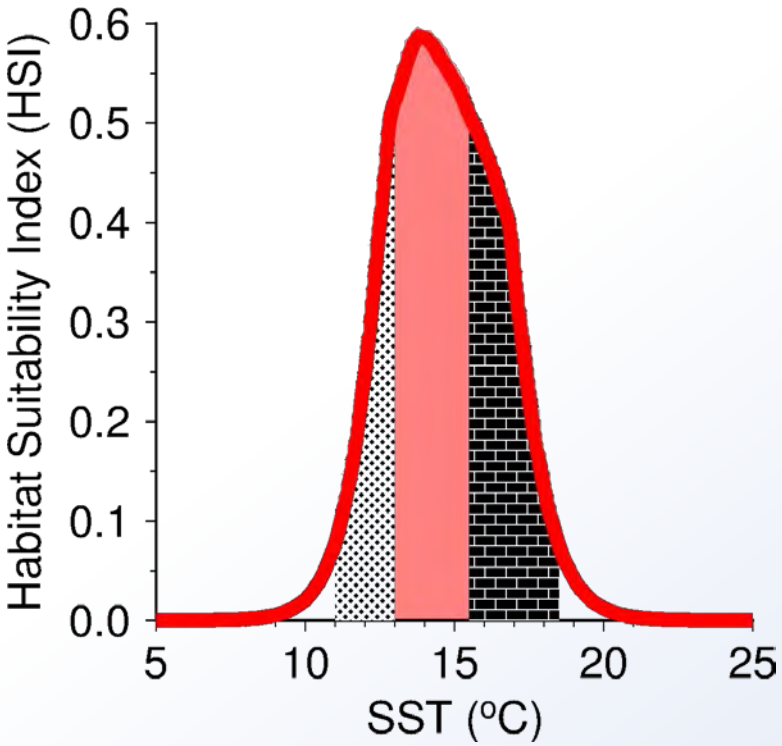
Results & Discussion: Warming impact on spatial habitat pattern



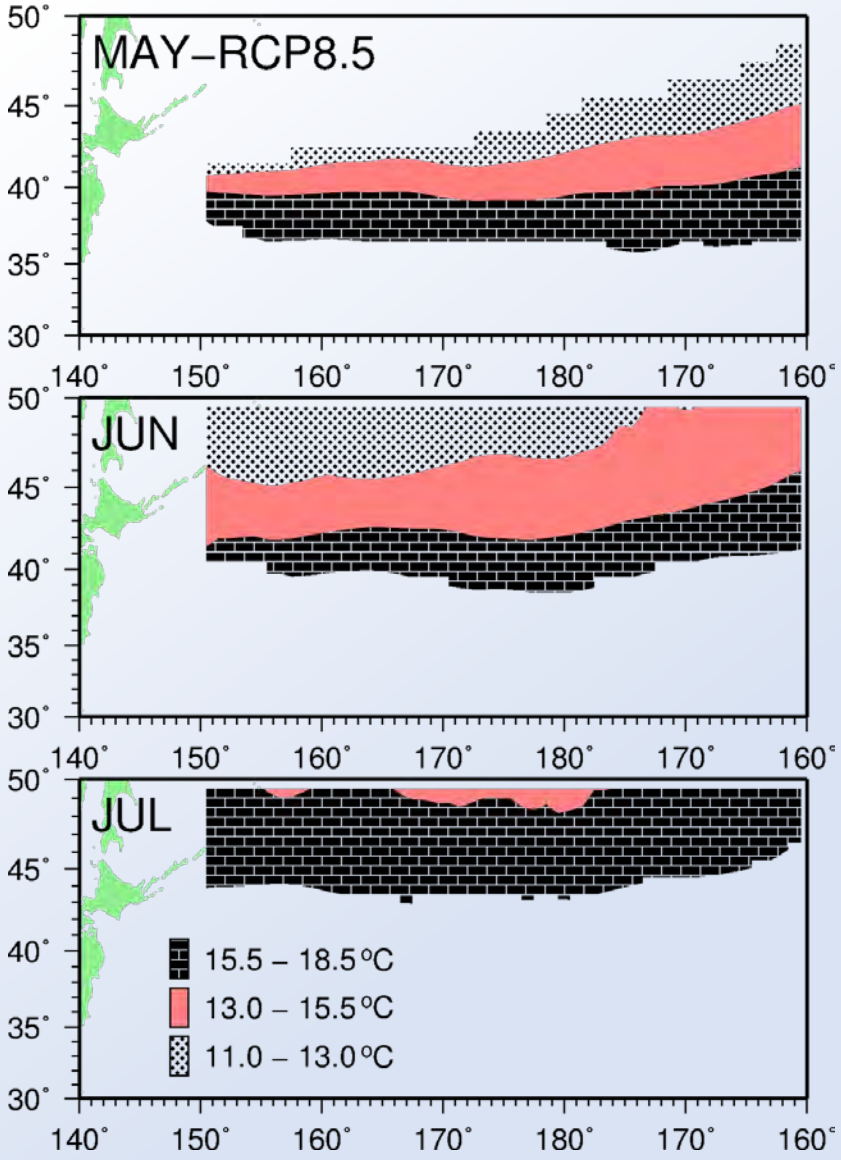


Squid habitat changes were proportional to the degree of warming

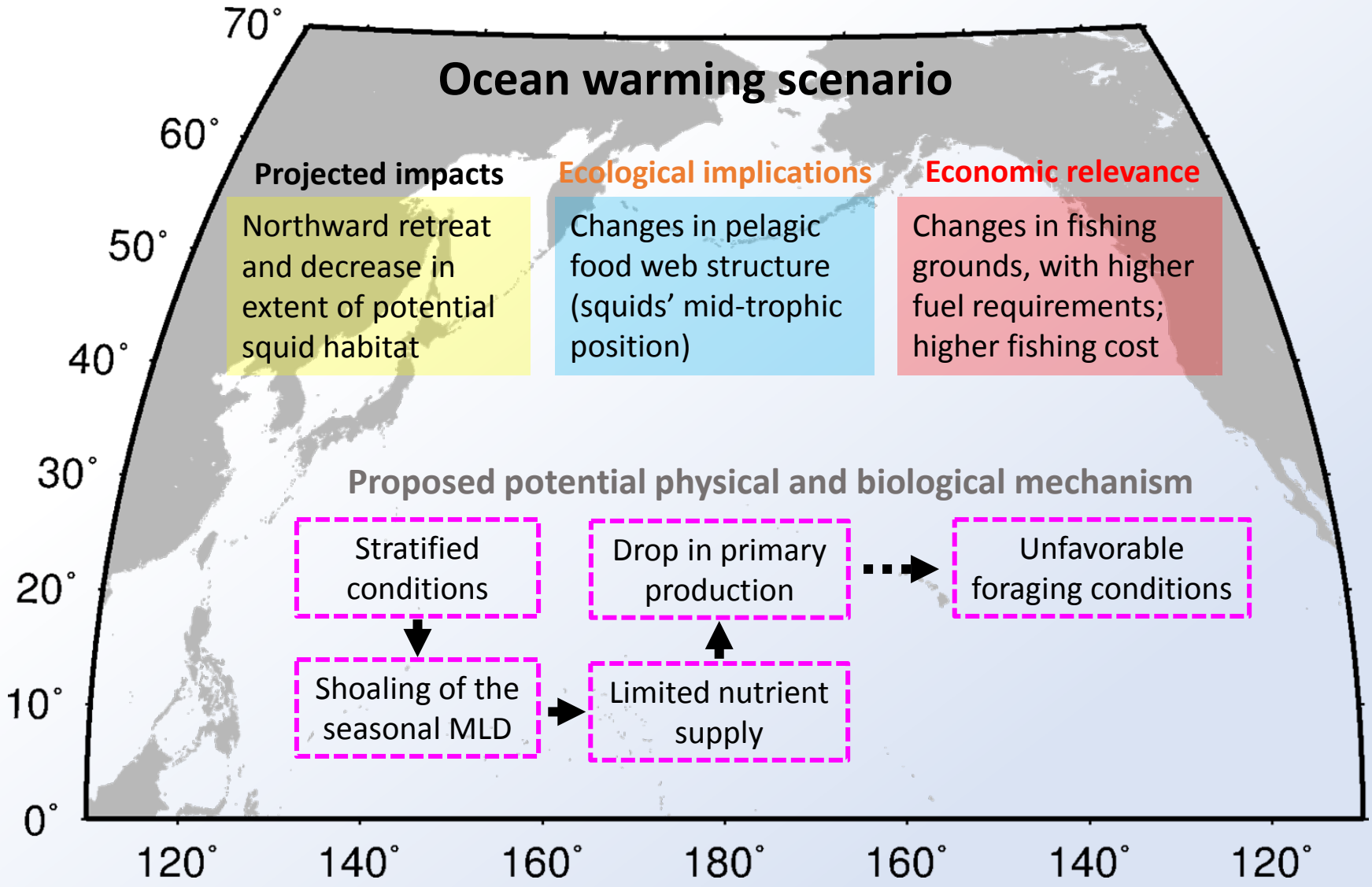
Results & Discussion: Spatial distribution of favorable SST



Optimal SST showed highest areal reduction under the highest warming scenario



Summary & Conclusion



Thank you for your kind attention