

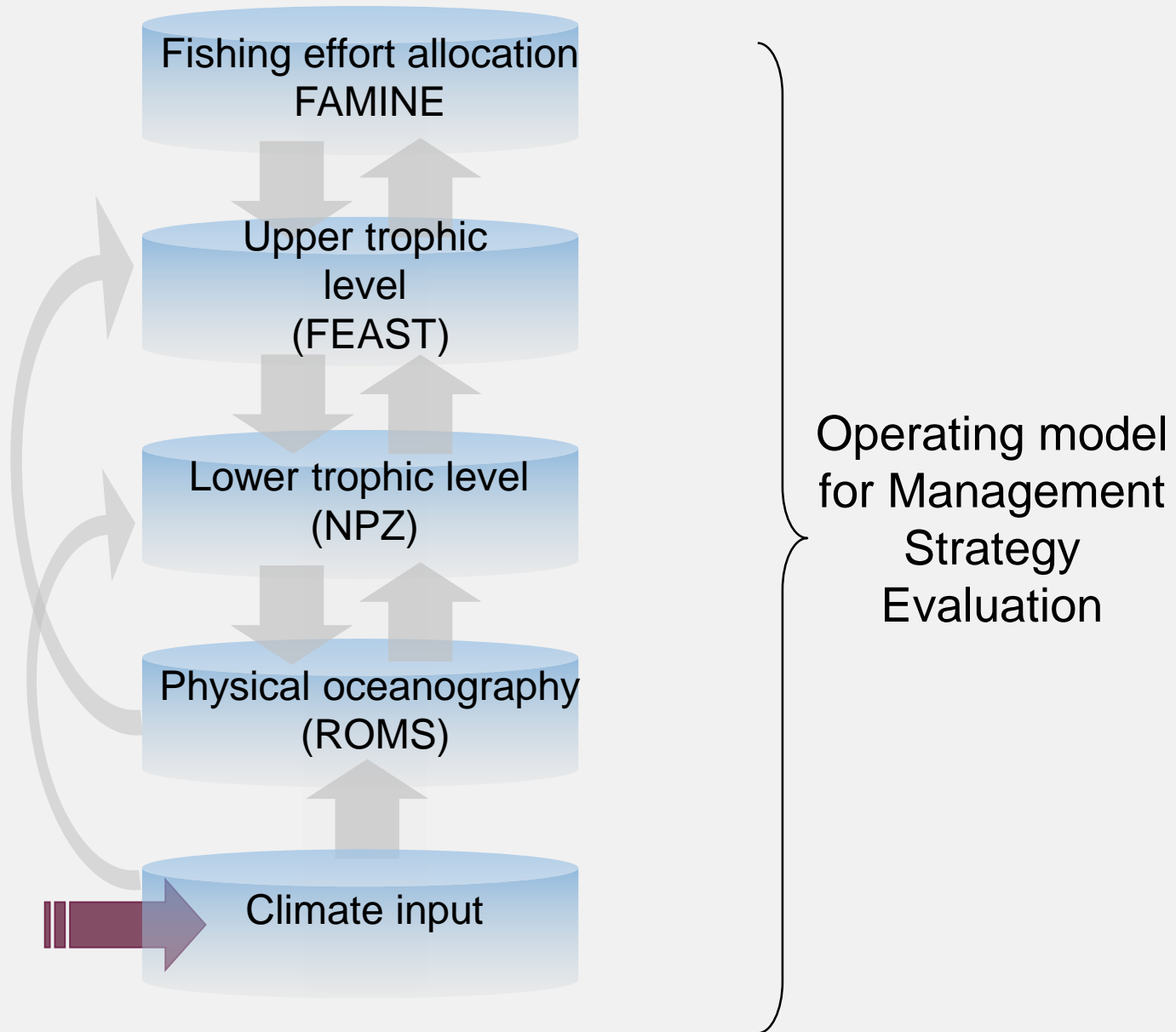


Fish Movement: Capturing Feeding Ecology in a Climate to Fisheries Model

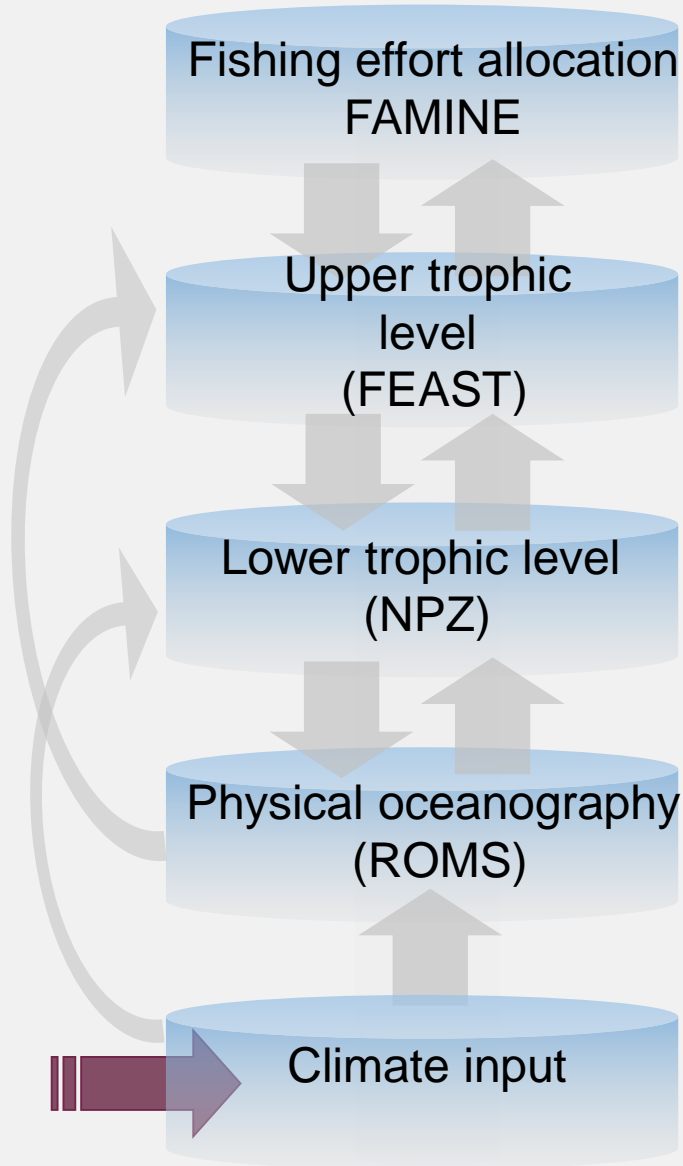
Ivonne Ortiz, Kerim Aydin, Al Hermann
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- Model set-up
- Feeding ecology & Fish movement
- Emergent functional response & distributions
- Challenges
- Future directions

Bering 10K ROMS-NPZD-FEAST



Acknowledgements Modeling group



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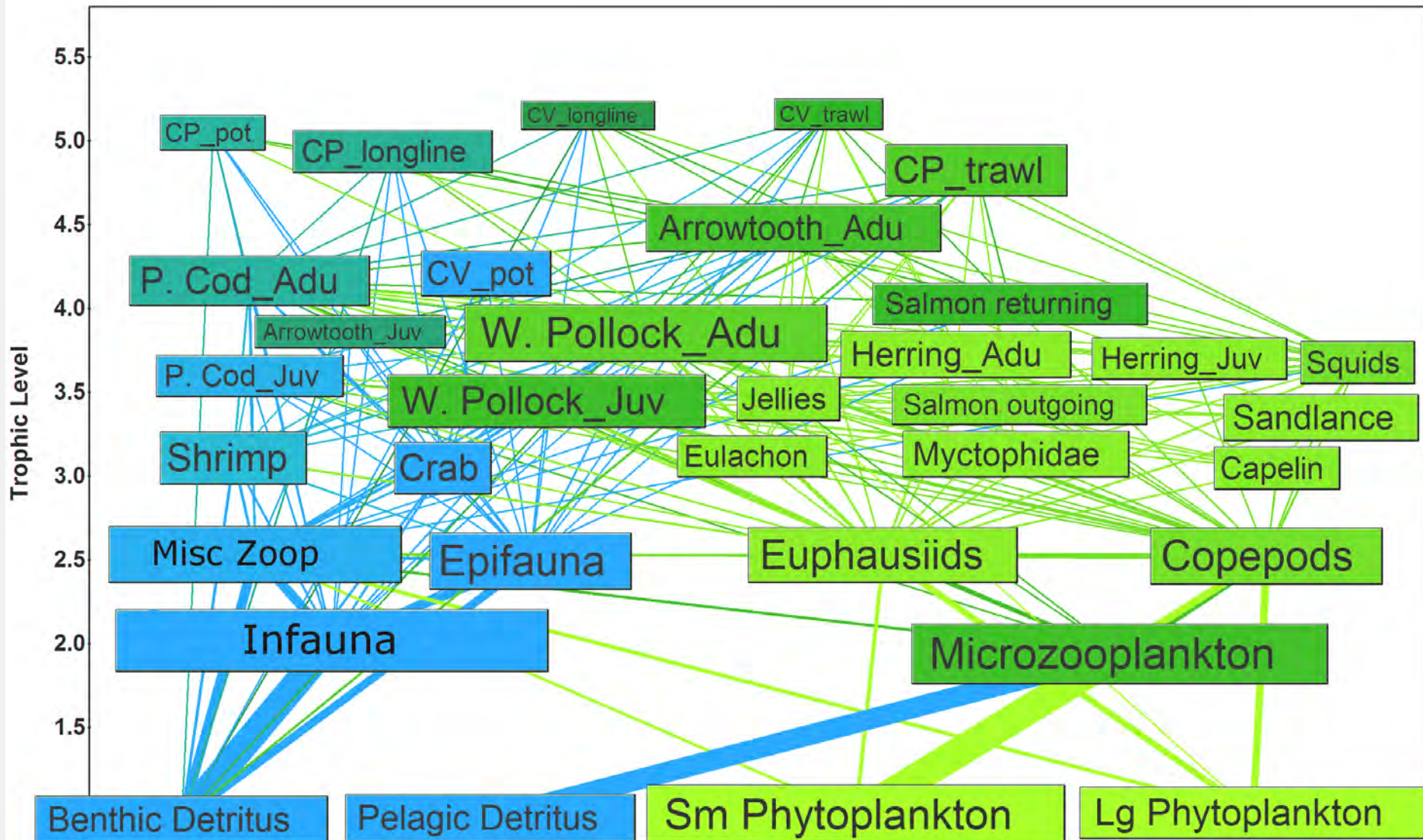
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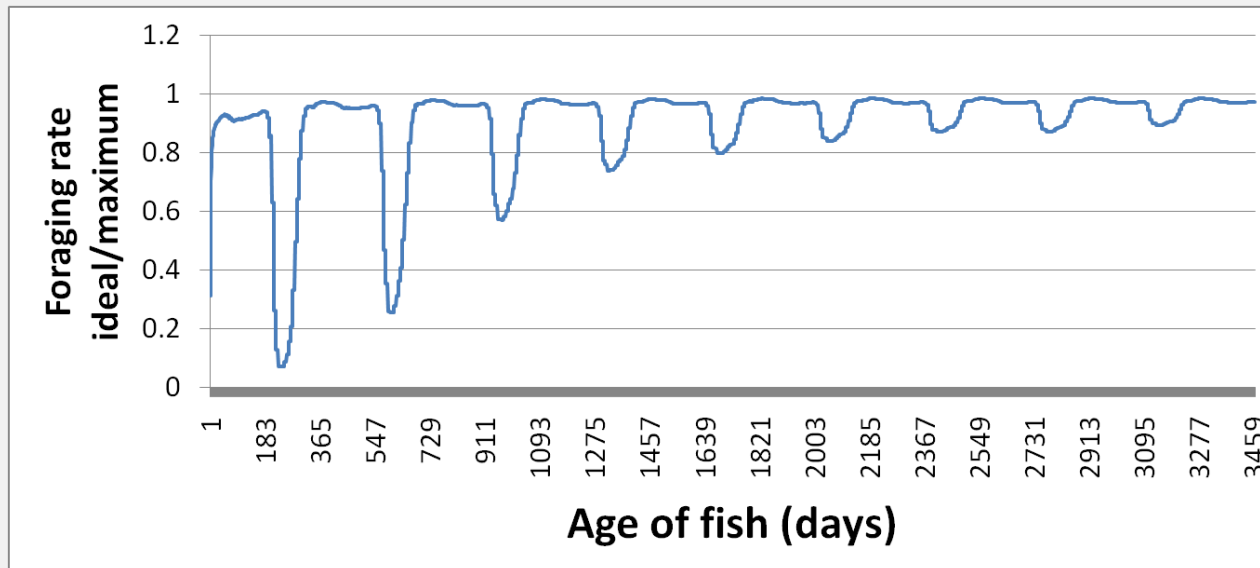
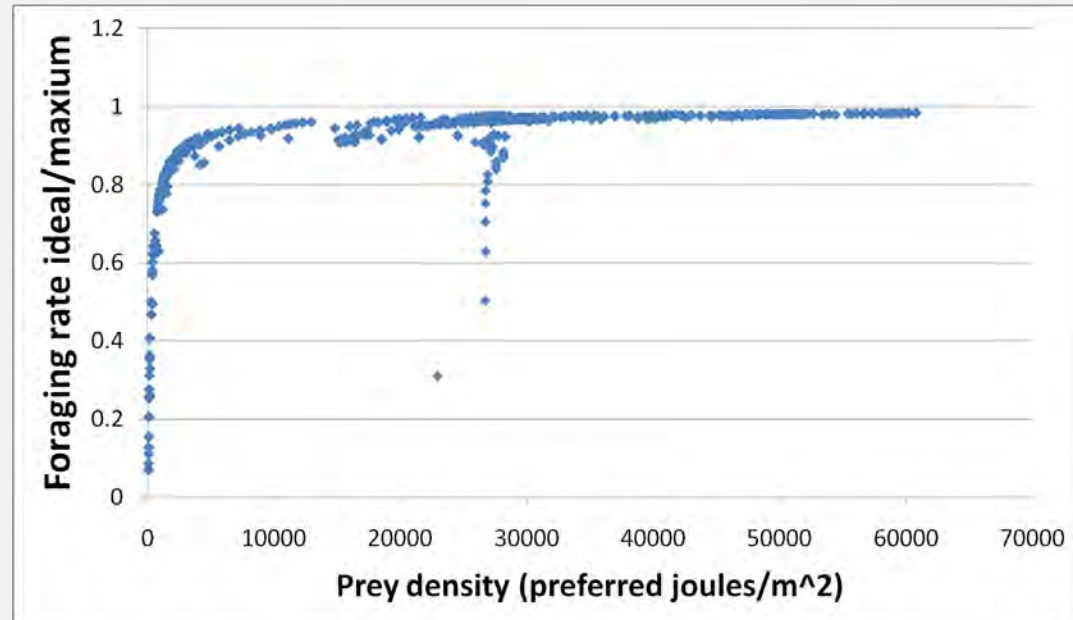
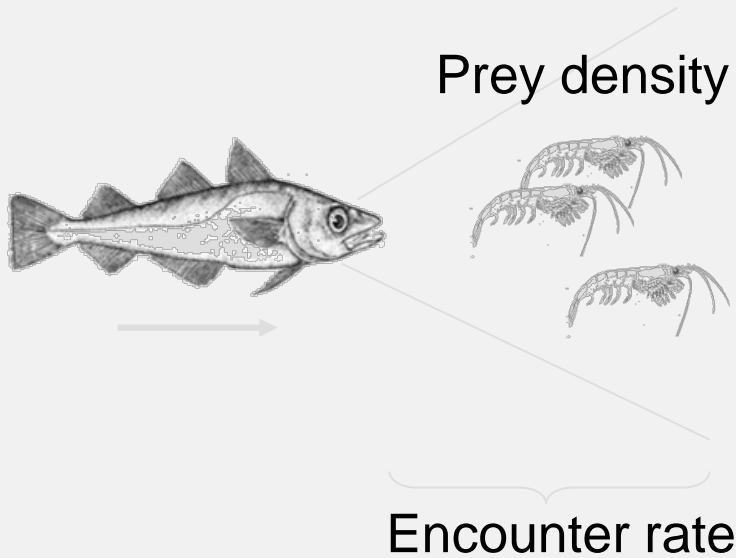
NPZD-FEAST Food web



Capturing feeding ecology

- Prey preference is species specific
- Prey selectivity is size based
- Prey availability is based on prey abundance and size selectivity
- Emerging functional response

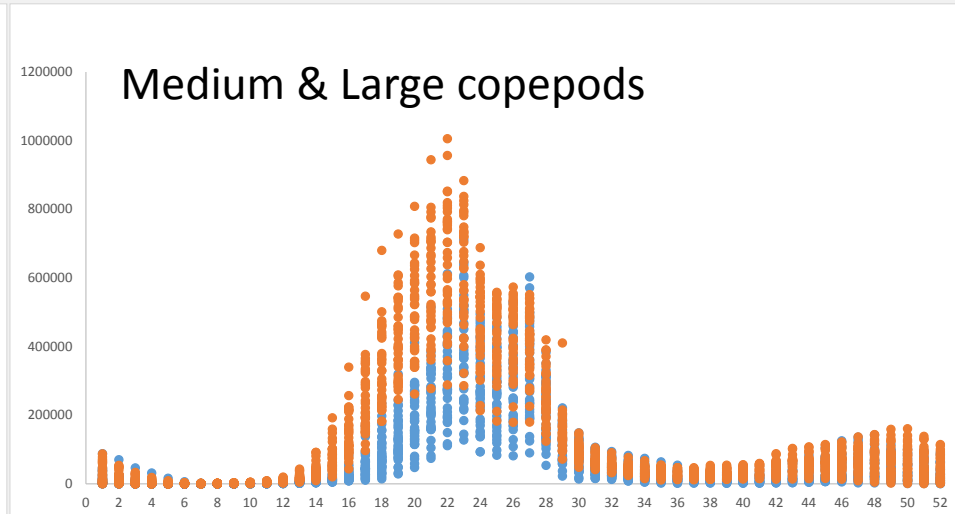
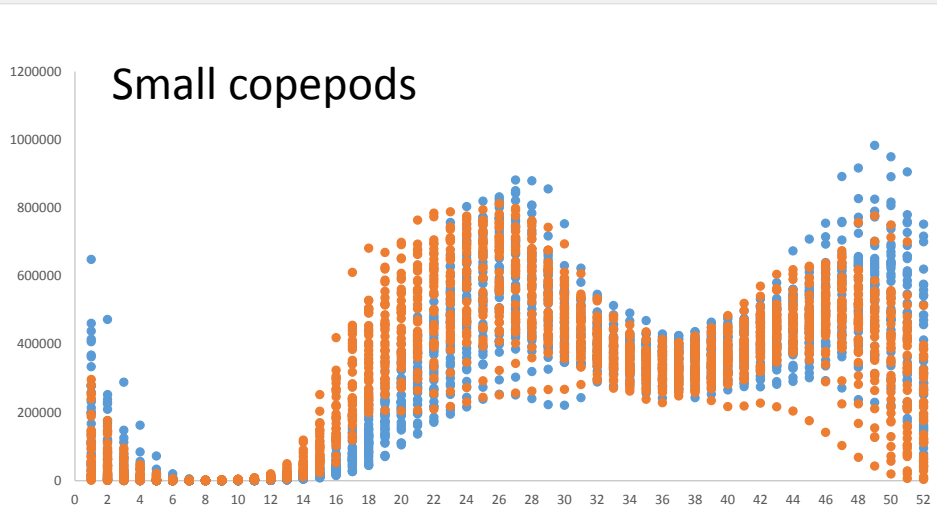
Capturing feeding ecology



Capturing feeding ecology

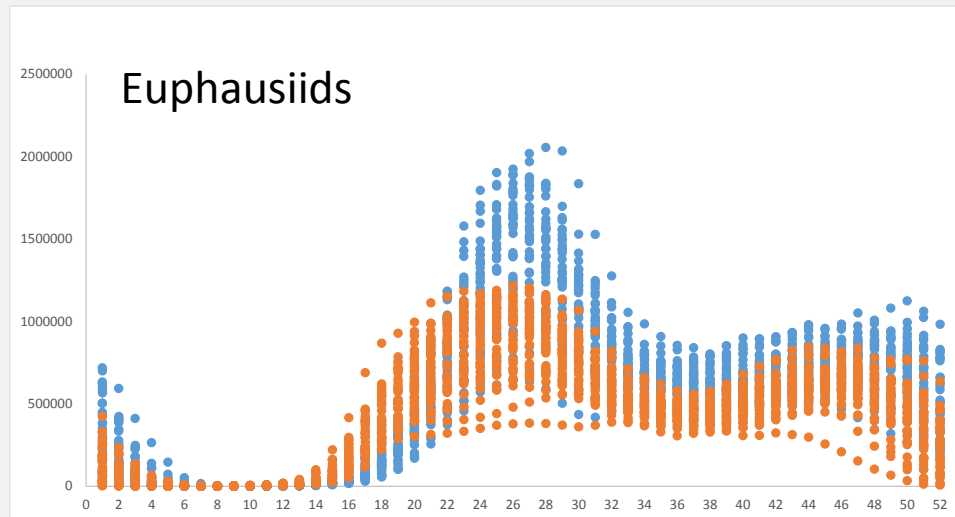
- Follow prey: too static & get eaten
- Follow prey and diffuse: enough movement & get eaten, predator/prey high density clusters
- Follow prey, avoid predators, diffuse: enough movement, some get eaten, less clustering
- Follow and deplete prey, avoid predators and diffuse

Do fish make a difference in zooplankton?



NPZ \longrightarrow Fish one way feedback

NPZ \longleftrightarrow Fish Two way feedback

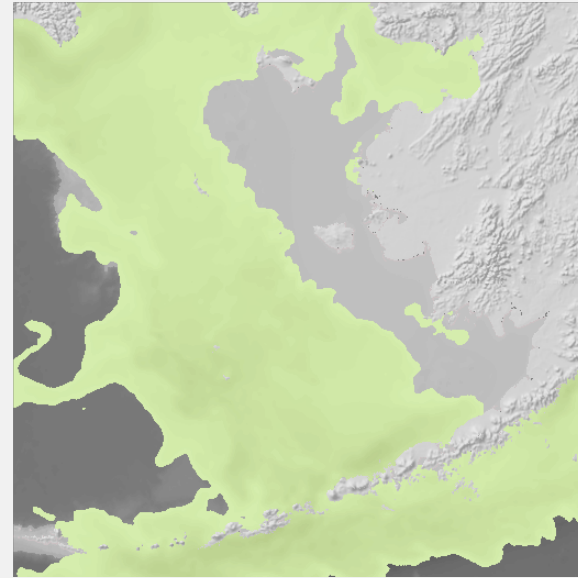


Large crustacean zooplankton as prey

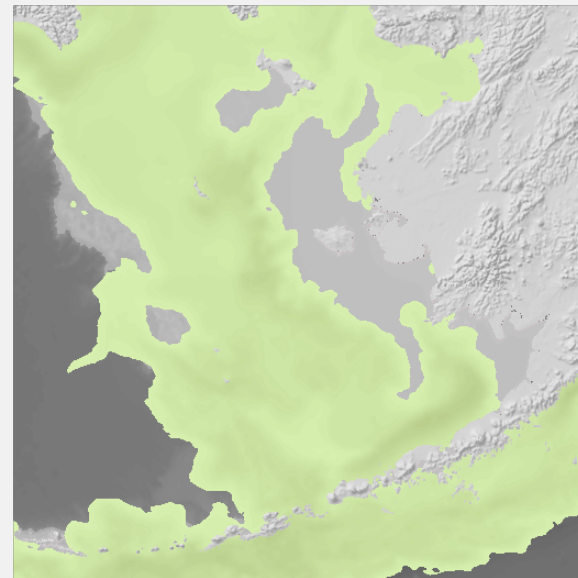
Copepods+
euphausiids

NPZ \longleftrightarrow Fish
Two way feedback

NPZ \longrightarrow Fish one
way feedback

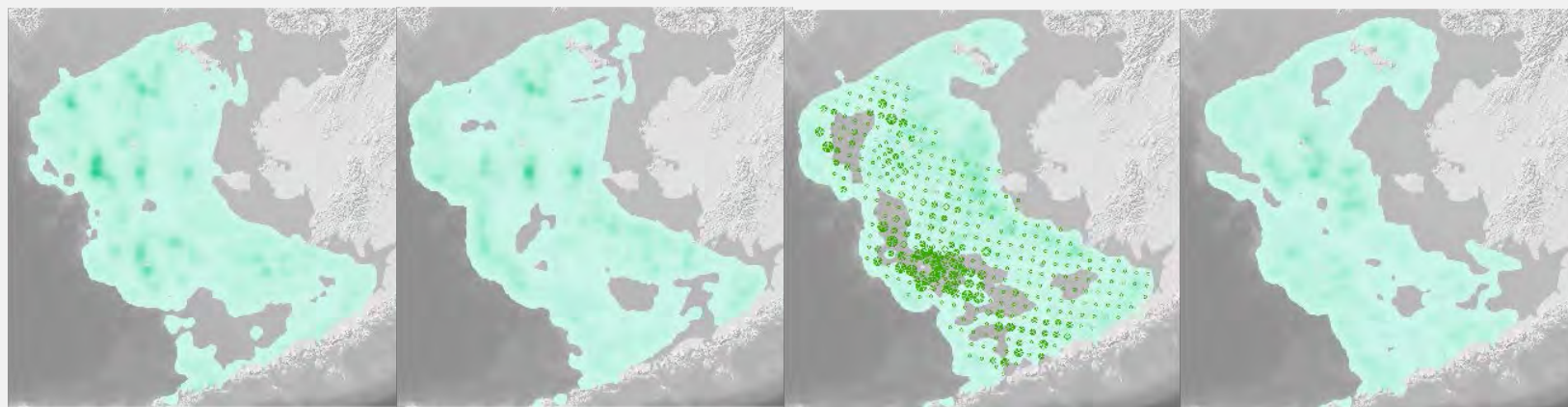


2004
2way



2004
1way

Seasonal distribution age 3+ pollock



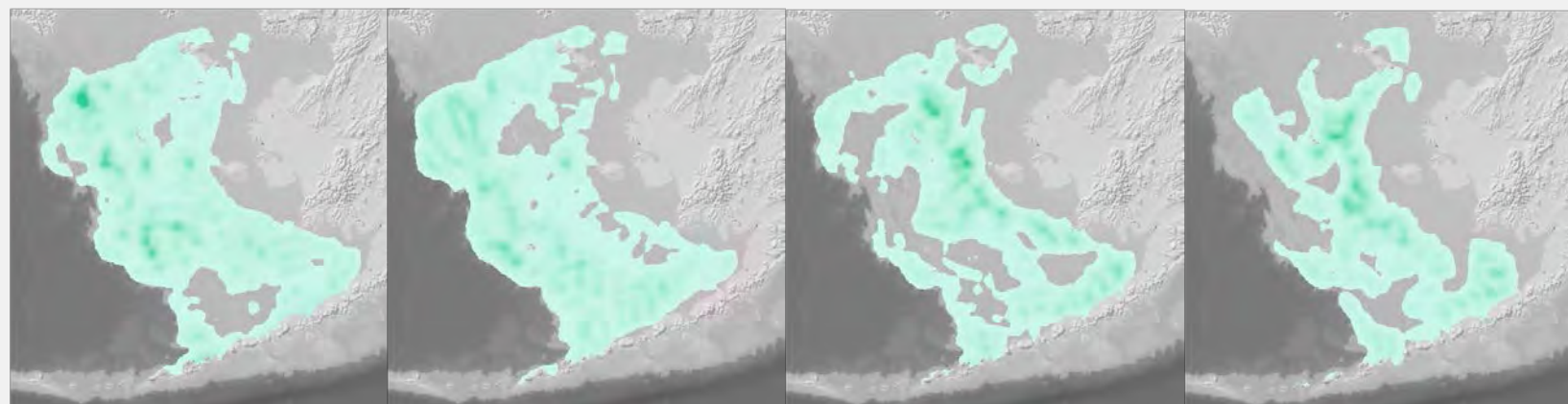
2004
2way

Winter

Spring

Summer

Fall



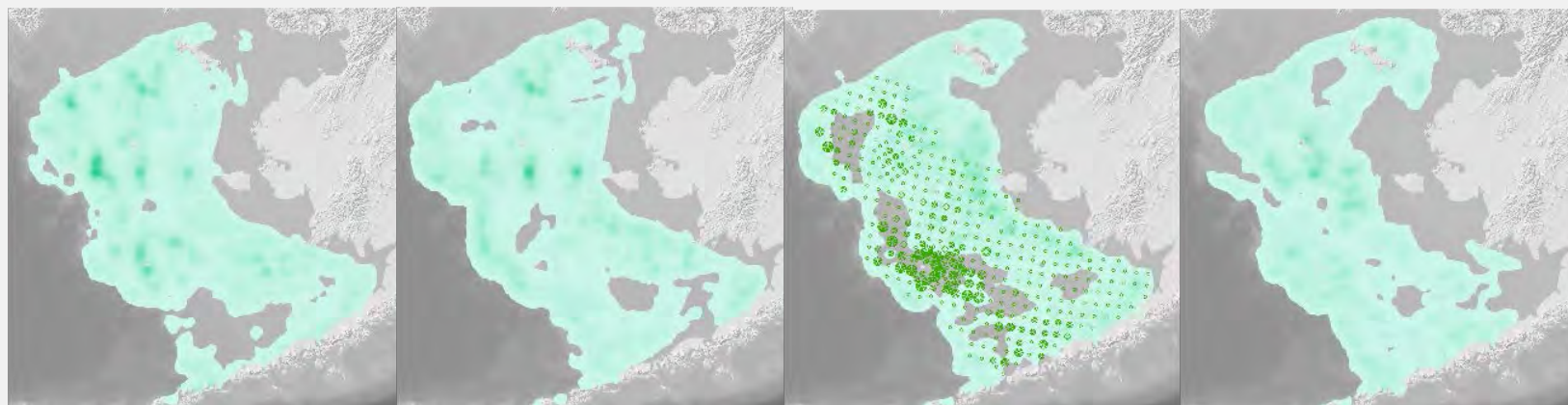
2004
1way

Next slide: video of hindcast simulation for the eastern Bering Sea using Bering 10K ROMS-NPZD-FEAST

Compared weekly output for 2004 (warm year) and 2008 (cold year). Shown are bottom temperature with cold pool in dark blue; ice cover in white and icephytoplankton in green.



Seasonal distribution age 3+ pollock

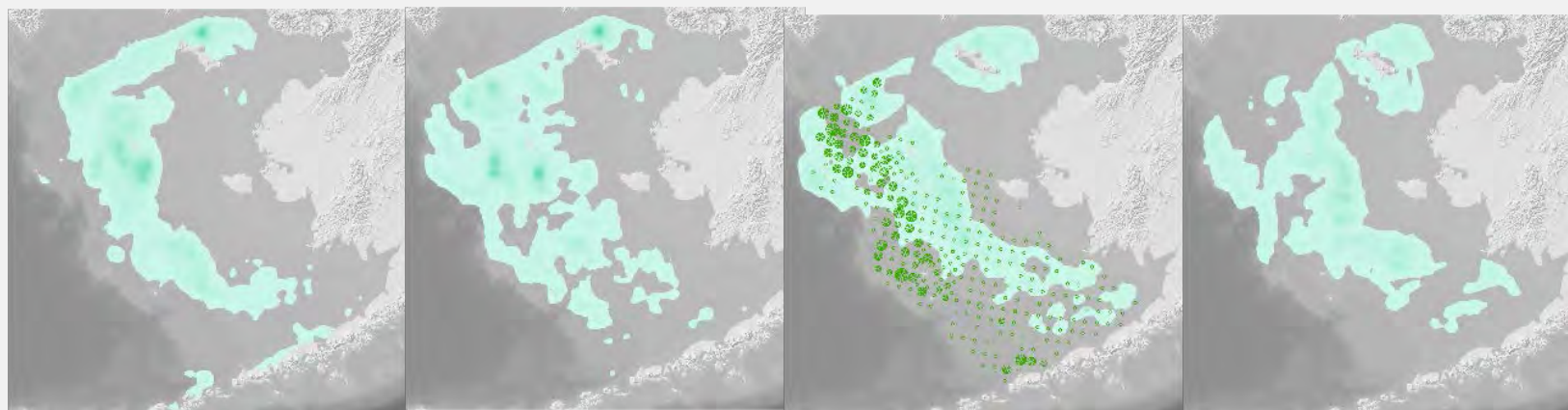


Winter

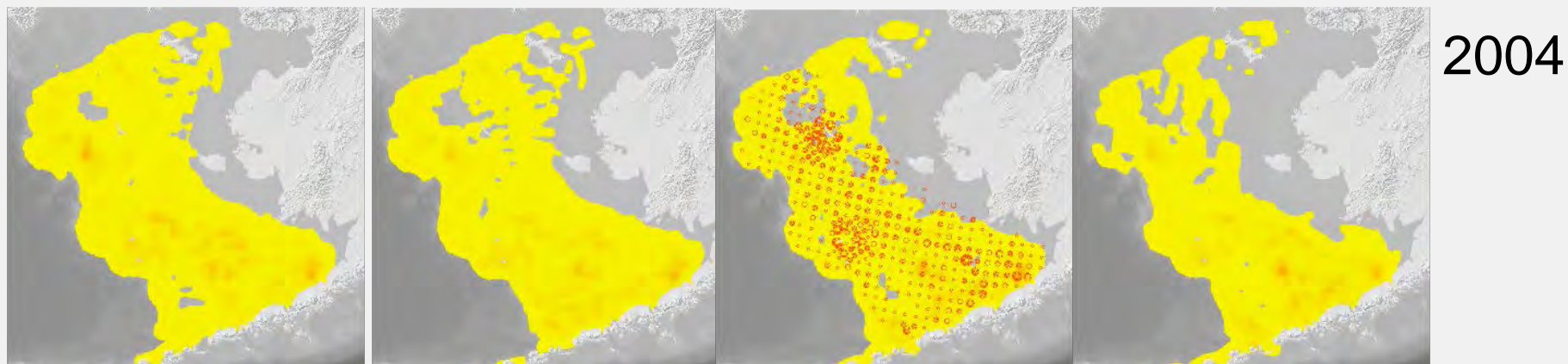
Spring

Summer

Fall



Seasonal distribution age 3+ cod

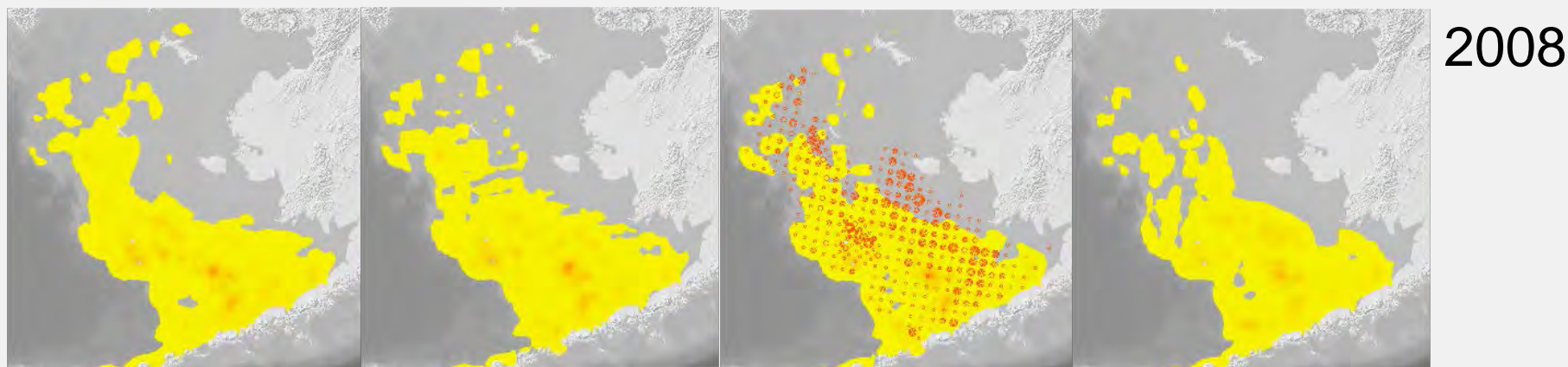


Winter

Spring

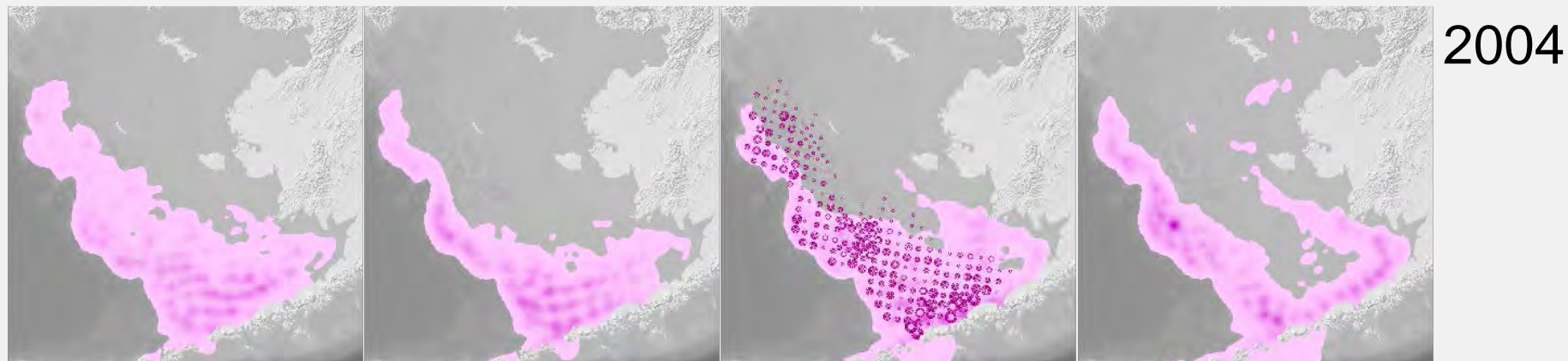
Summer

Fall



2008

Seasonal distribution age 3+ arrowtooth

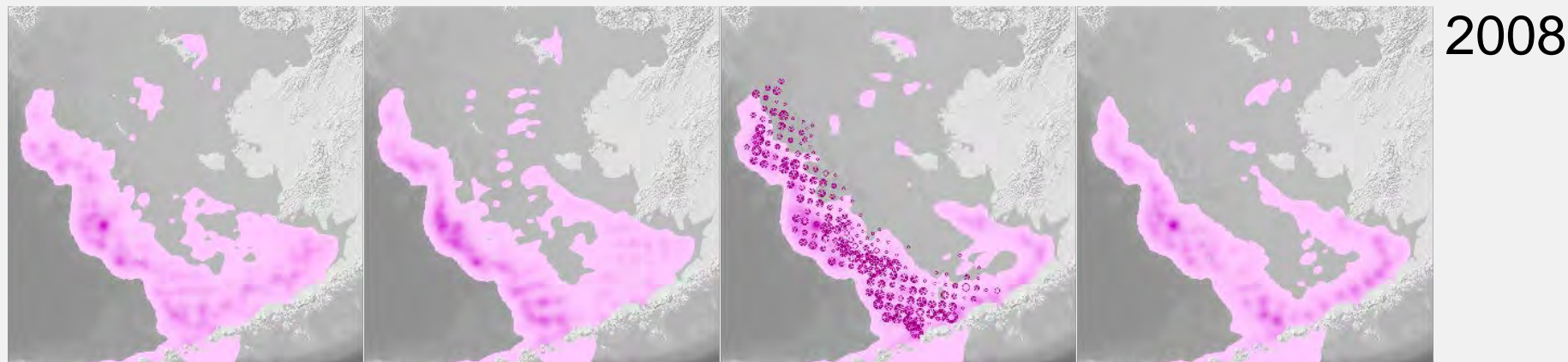


Winter

Spring

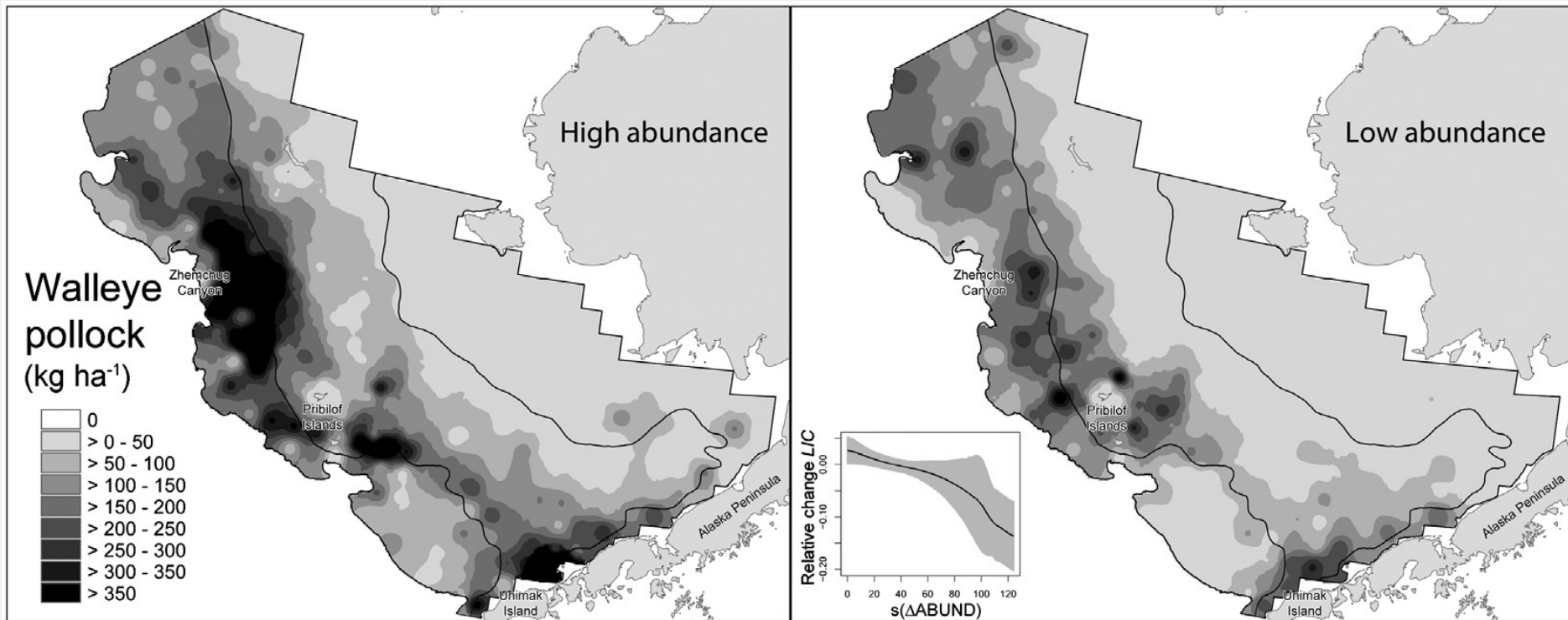
Summer

Fall



2008

Challenges: Distribution and abundance GAM survey data & cold pool extent



Lauth and Kotwicki 2013 Deep Sea Research II

High abundance

Low abundance

Future directions: Long term forecasts

Build library of forecasts based on different climate models (validated for eastern Bering Sea)

3 current forecasts to 2040

1 realization for each climate model

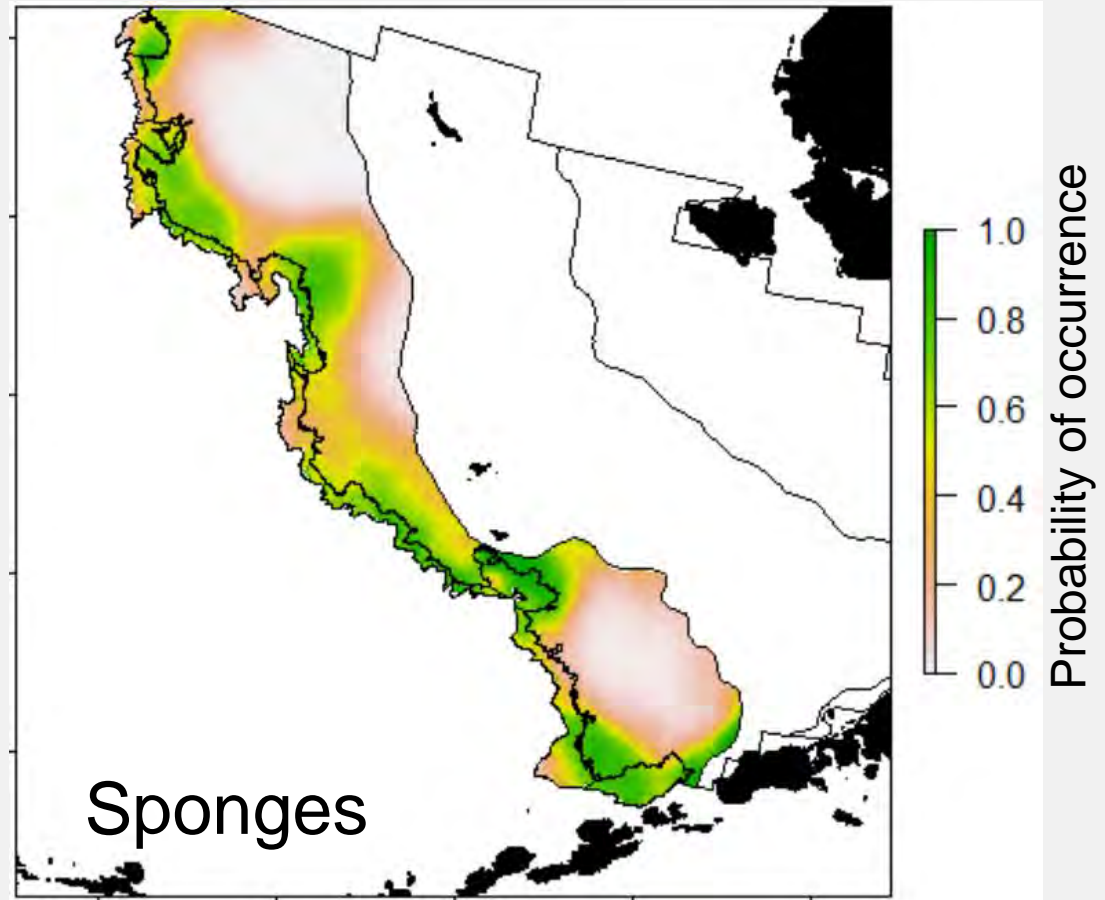
3 realizations per climate year by end of year

Future directions: Long term forecasts

Essential Fish
Habitat + ROMS

EFH based on
location,
temperature, slope,
tide, current

Use forecasted
temperatures to get
new distributions



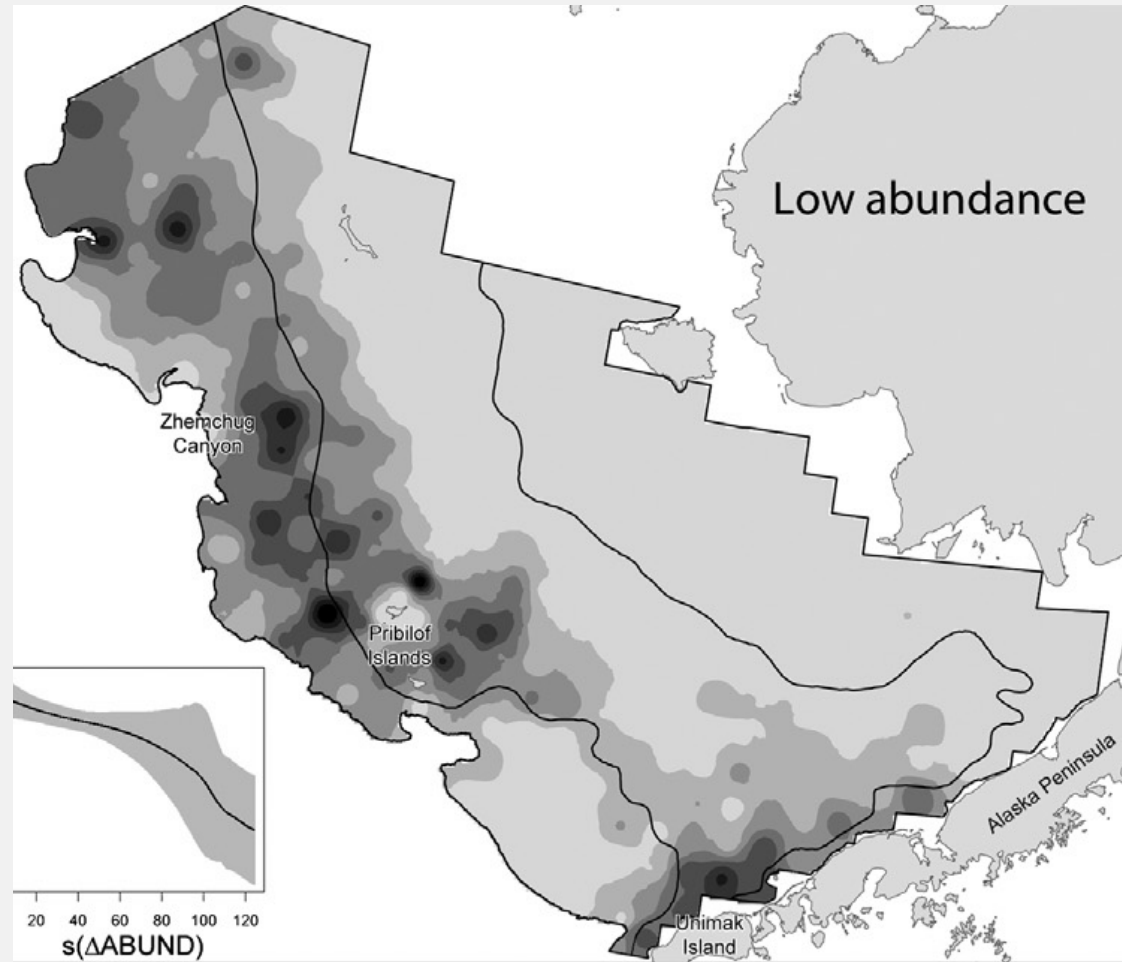
Chris Rooper, Ned Laman, Dan Cooper (RACE Division, AFSC, NMFS, NOAA);
contact Chris.Rooper@noaa.gov

Future directions: Long term forecasts

Fish Distribution
GAMS + ROMS

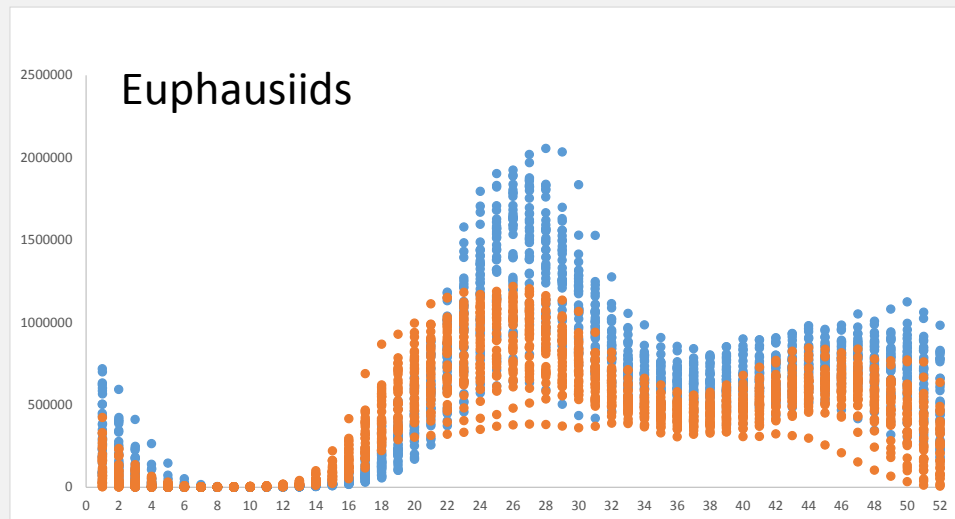
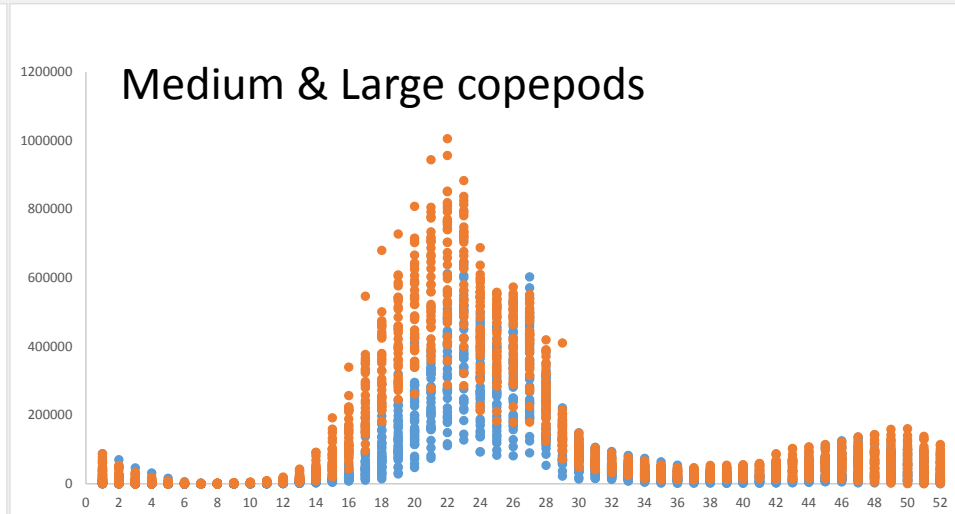
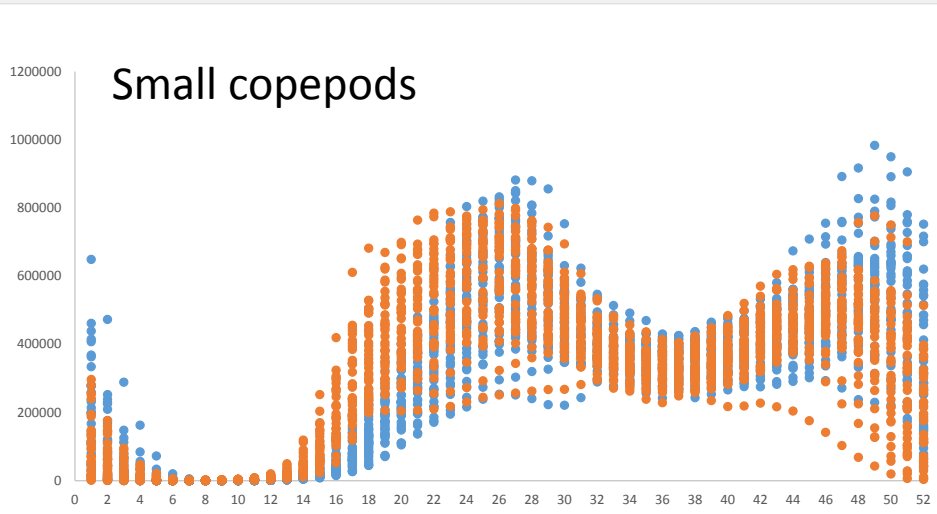
GAM based on
cold pool extent at
species specific
temperature
threshold

Use forecasted
cold pool to get
new distributions



Lauth and Kotwicky 2013 Deep Sea Research II

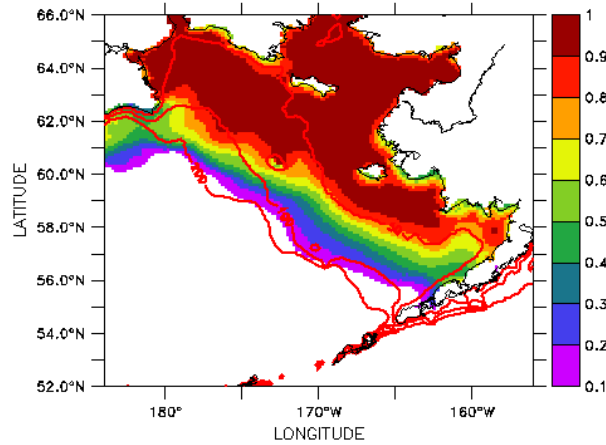
Challenge: phenology of primary and secondary production



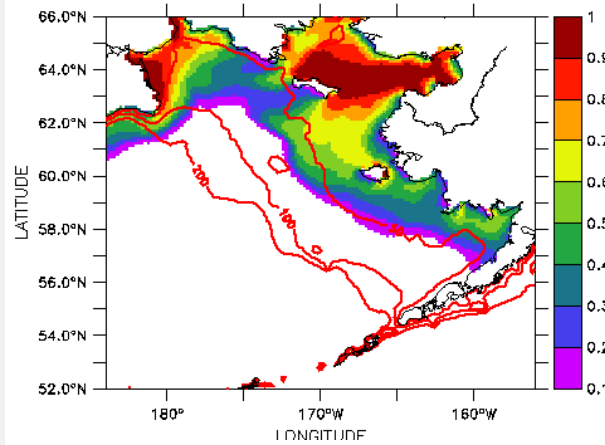
NPZ \longrightarrow Fish one way feedback

NPZ \longleftrightarrow Fish Two way feedback

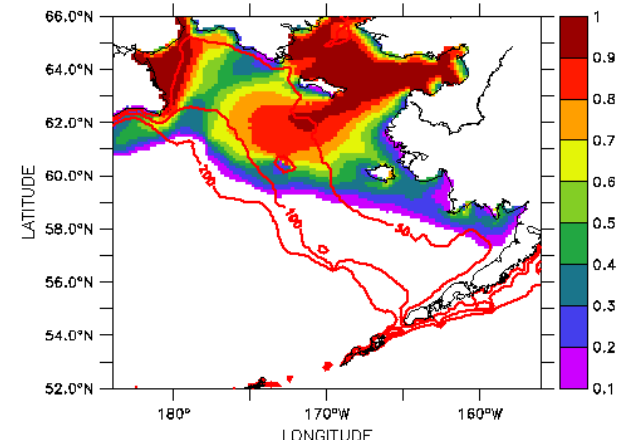
Future directions: Short term forecasts



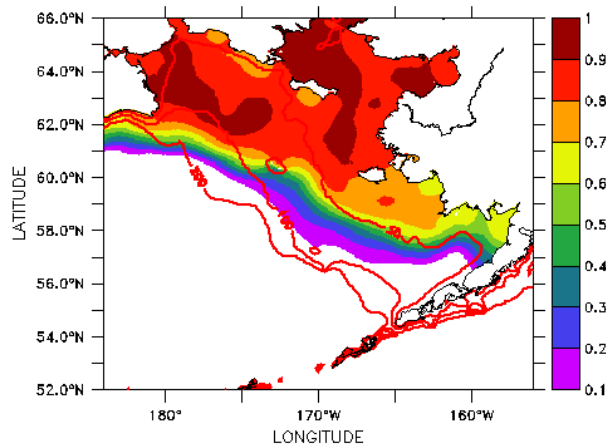
Modeled Jan 2012



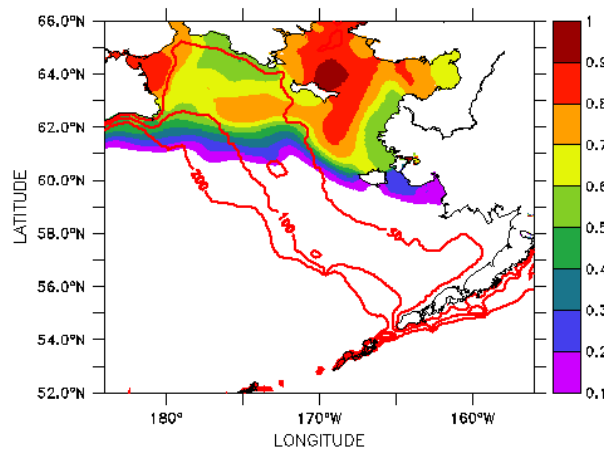
Predicted Jan 2014



Predicted Jan 2015



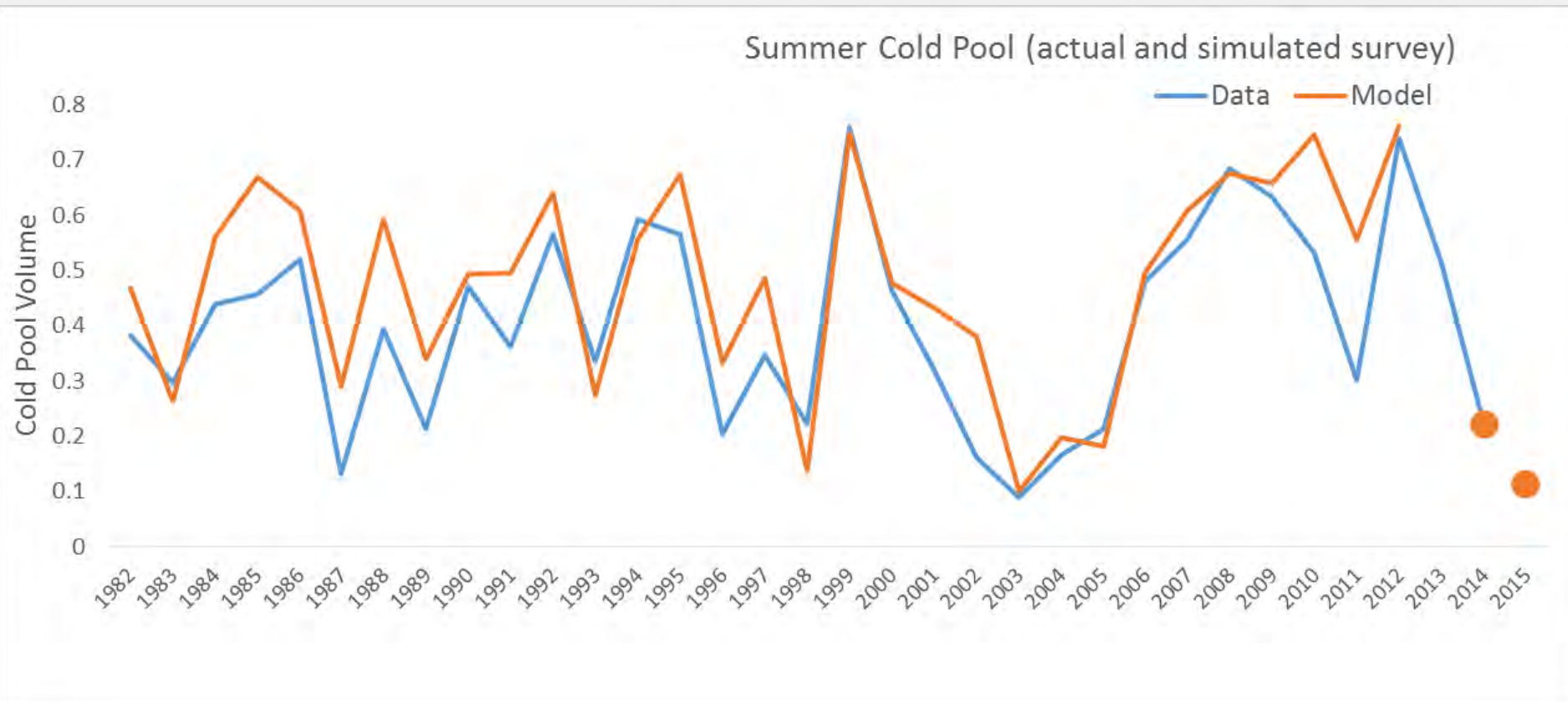
Observed Jan 2012



Observed Jan 2014

Contact Al Hermann
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Summer 2015 prediction (single realization)



Questions