

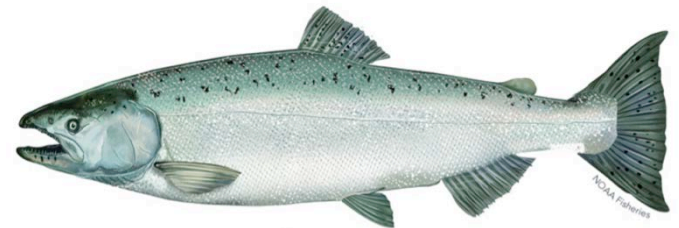
# Impacts of Shasta Dam Water Operations on Endangered Winter-Run Chinook Salmon

Eric Danner  
Ben Martin  
Miles Daniels  
Sara John  
Andrew Pike

Southwest Fisheries Science Center



**NOAA FISHERIES**



# Winter Run Habitat



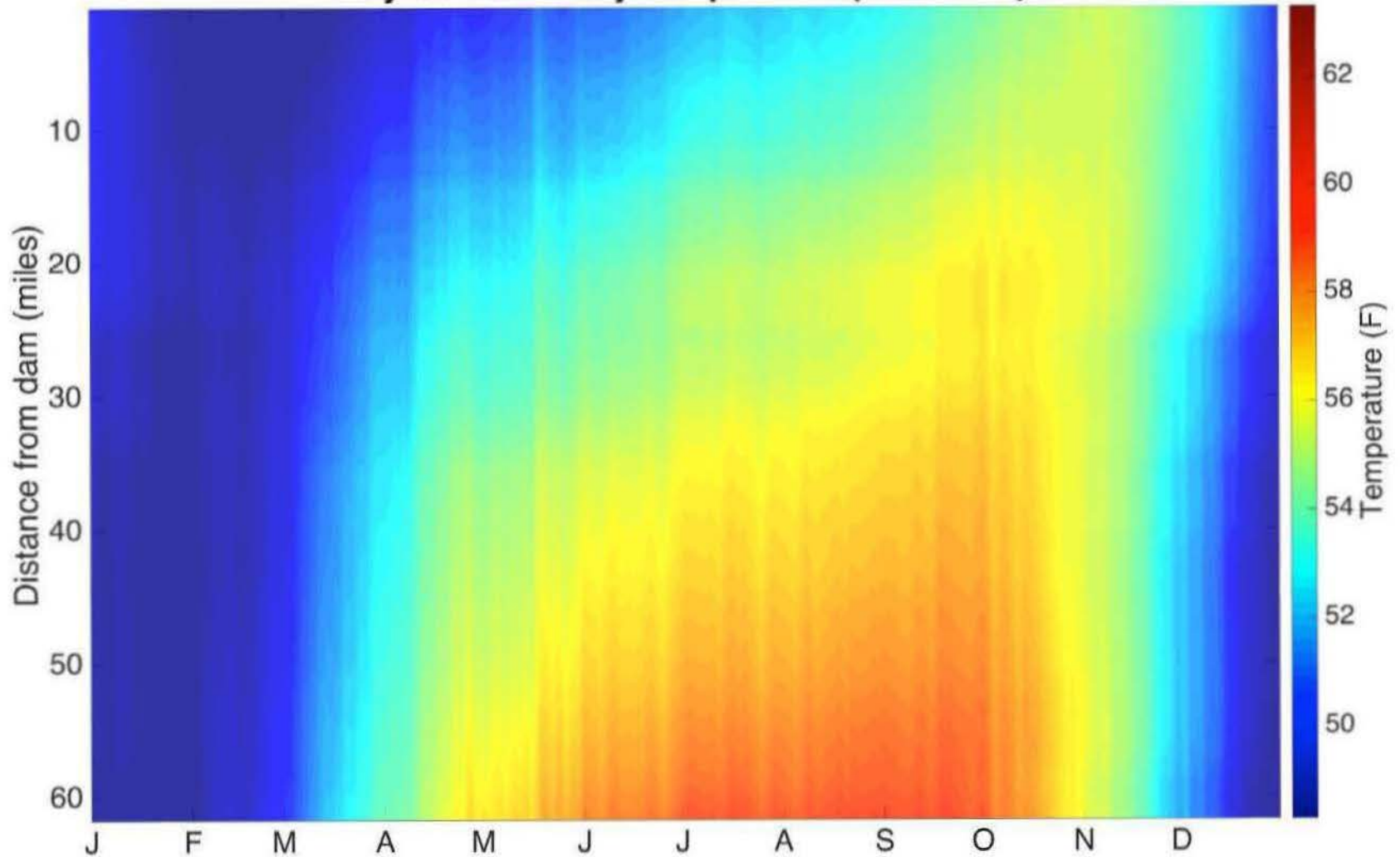
- Understand the flow and temperature dynamics
- Effects on salmon
- Useful for informing management





# Temperature Landscape

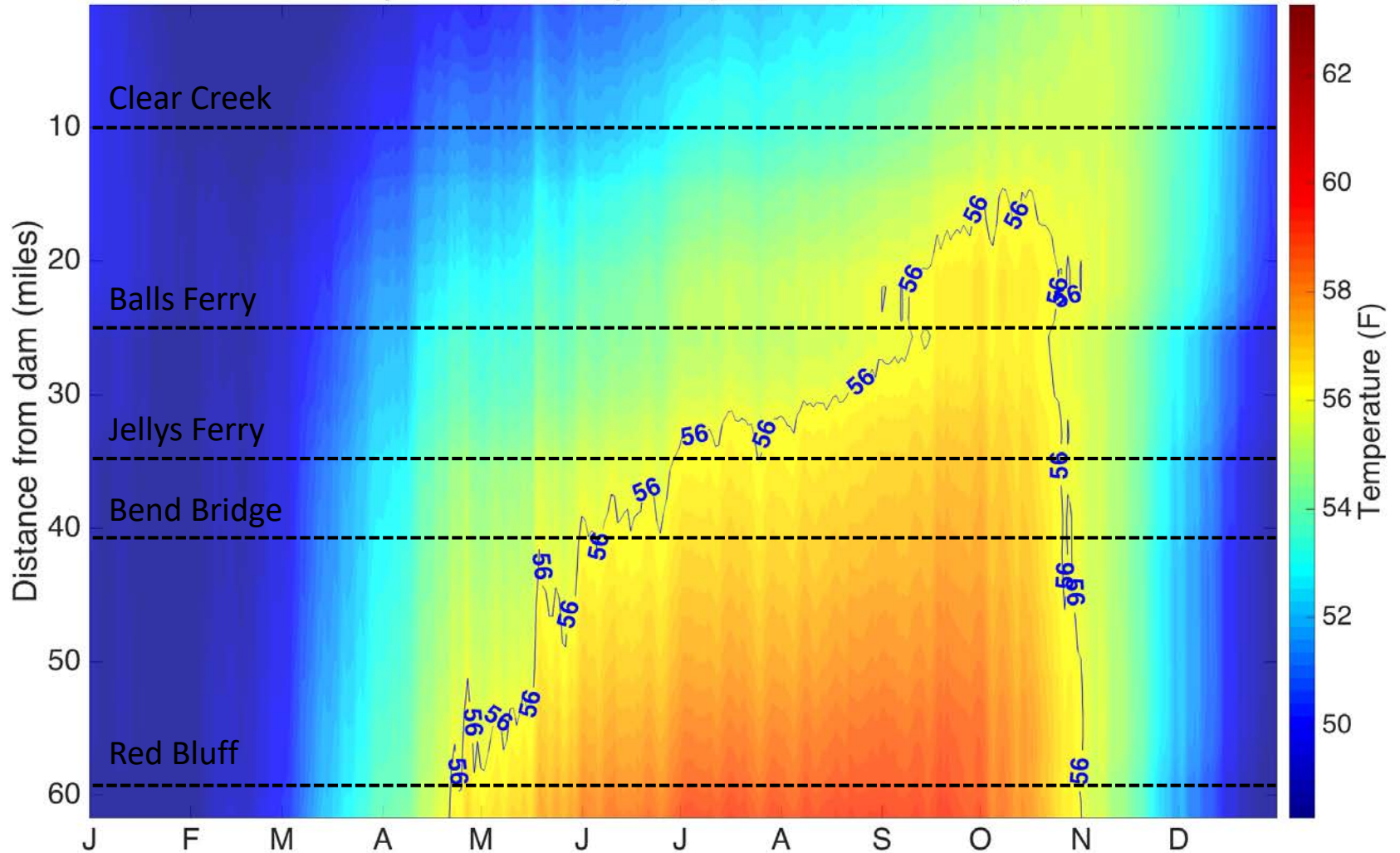
25 year Mean Daily Temperature (1990-2014)





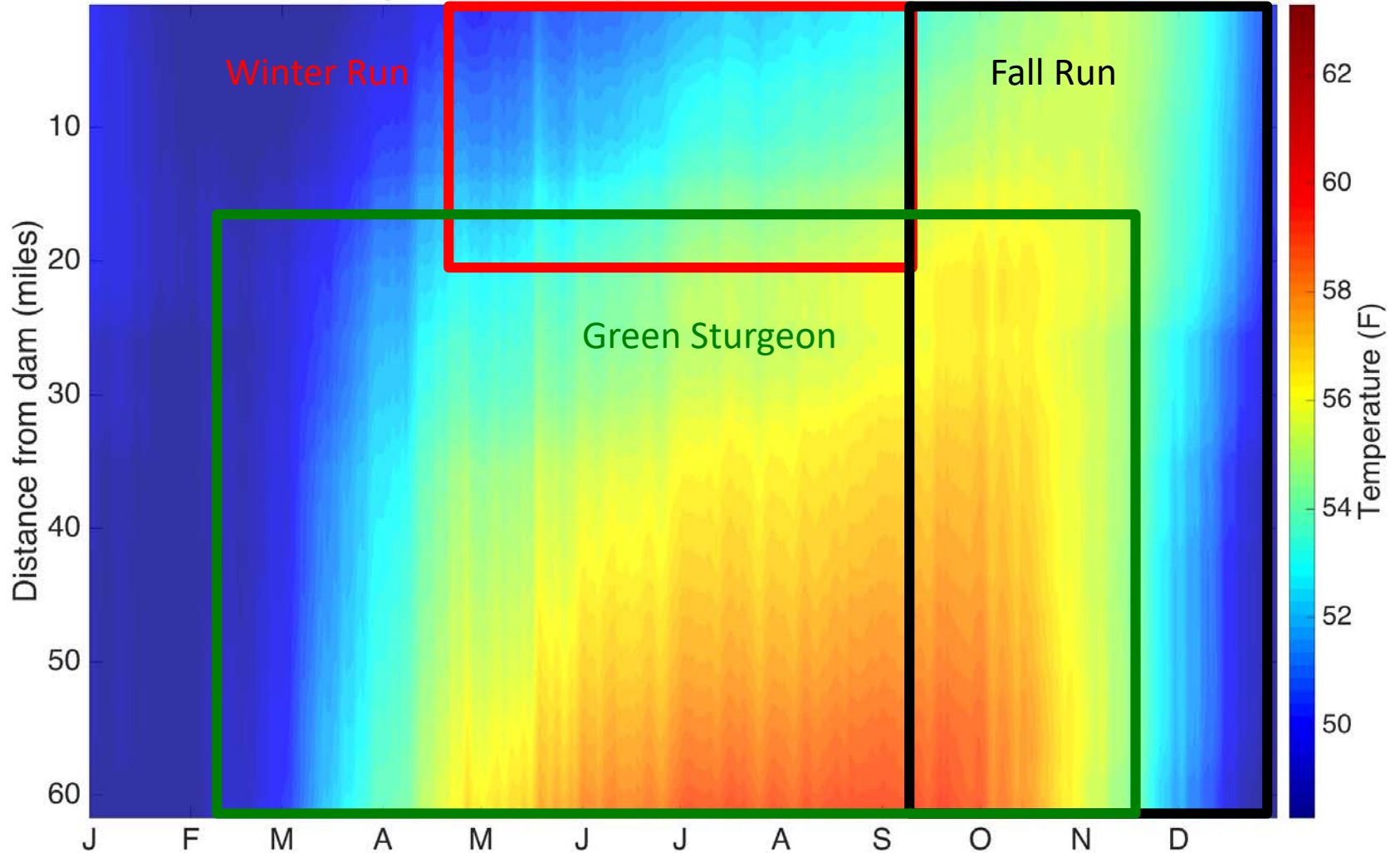
# Temperature Landscape

25 year Mean Daily Temperature (1990-2014)



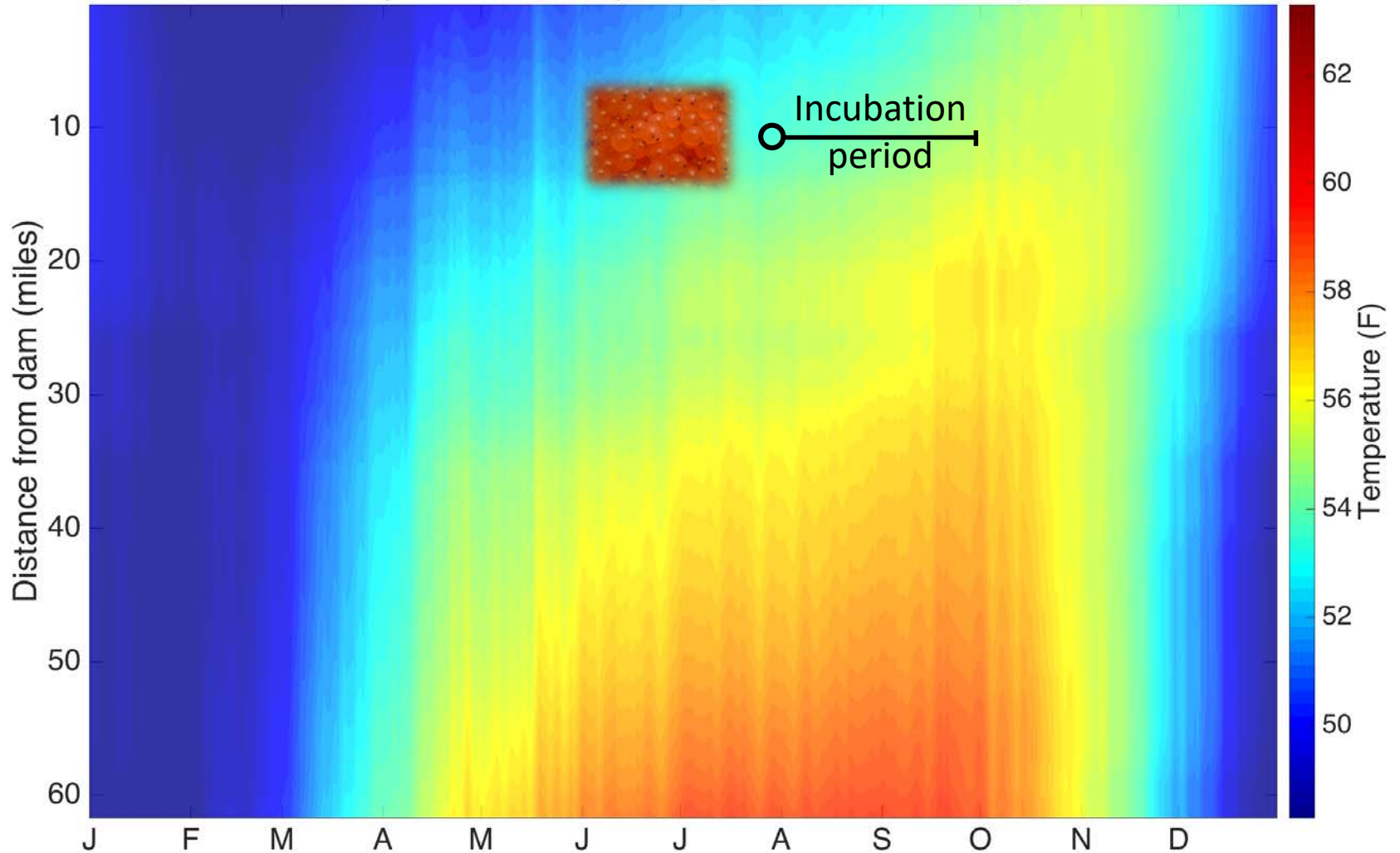
# Temperature Landscape

25 year Mean Daily Temperature (1990-2014)



# Temperature Landscape

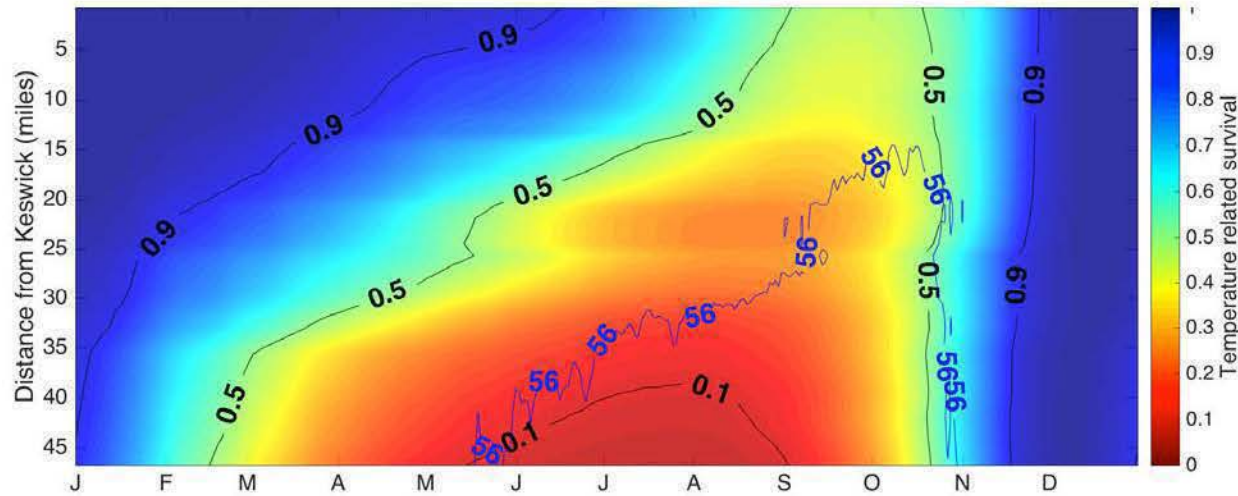
25 year Mean Daily Temperature (1990-2014)



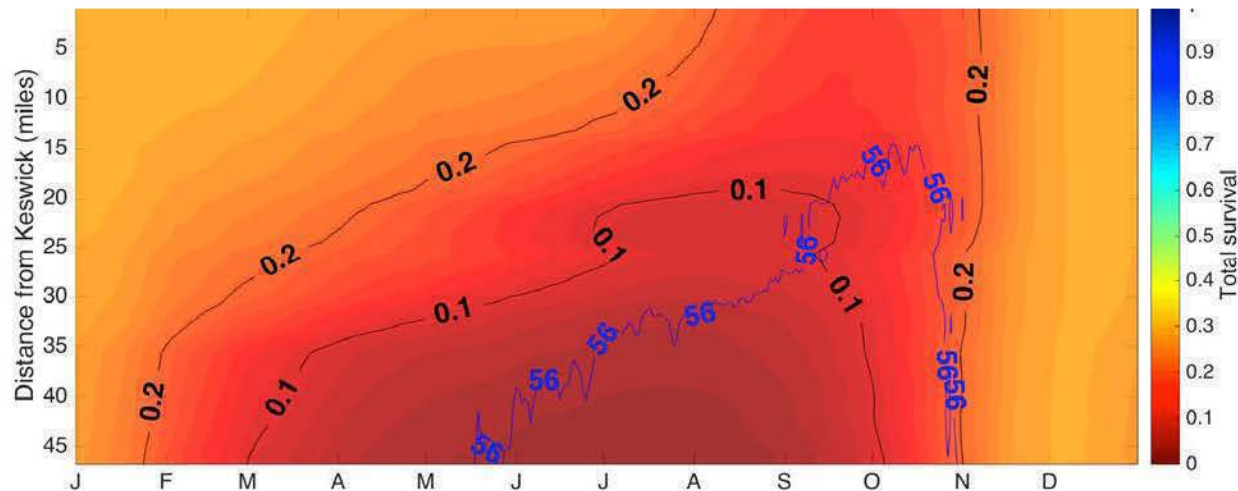




# Total Survival = Temperature Dependent Survival \* Background Survival

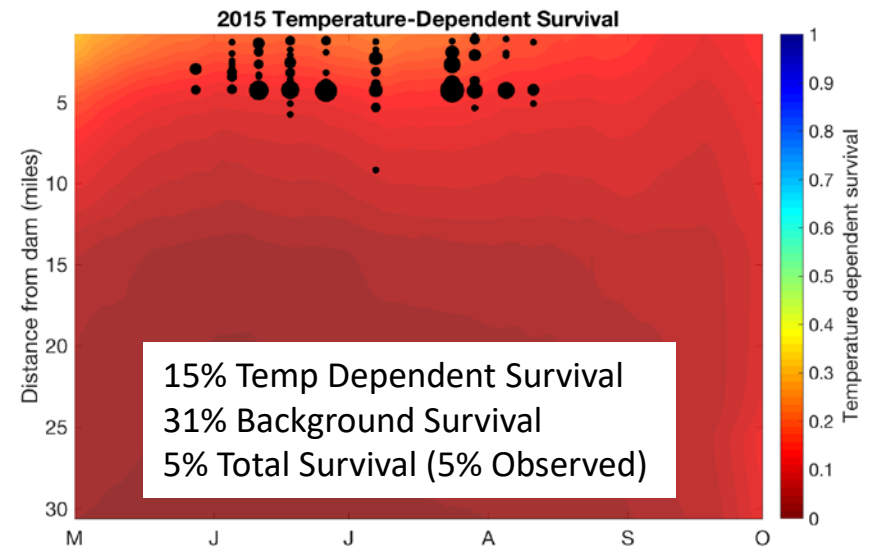
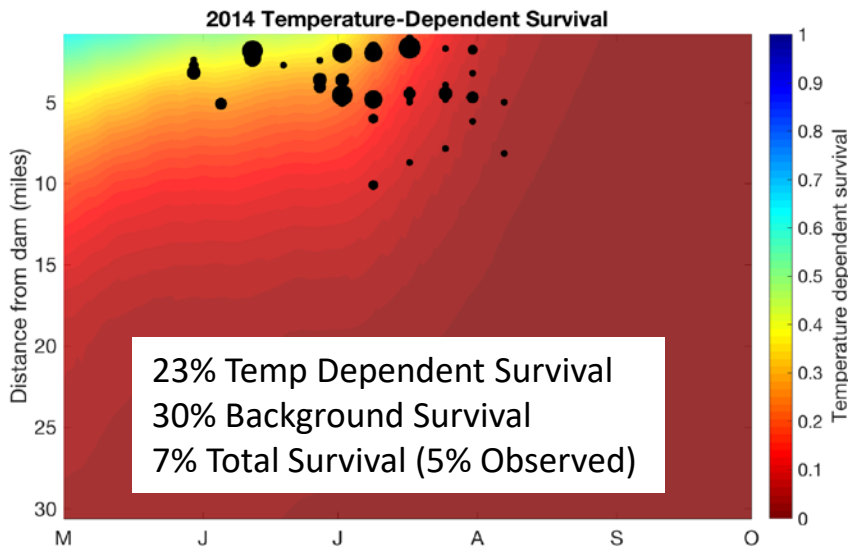
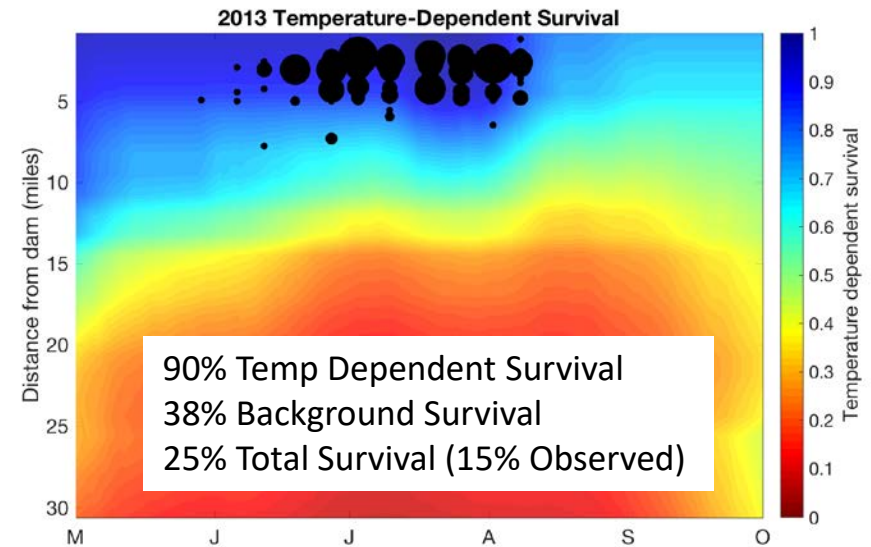
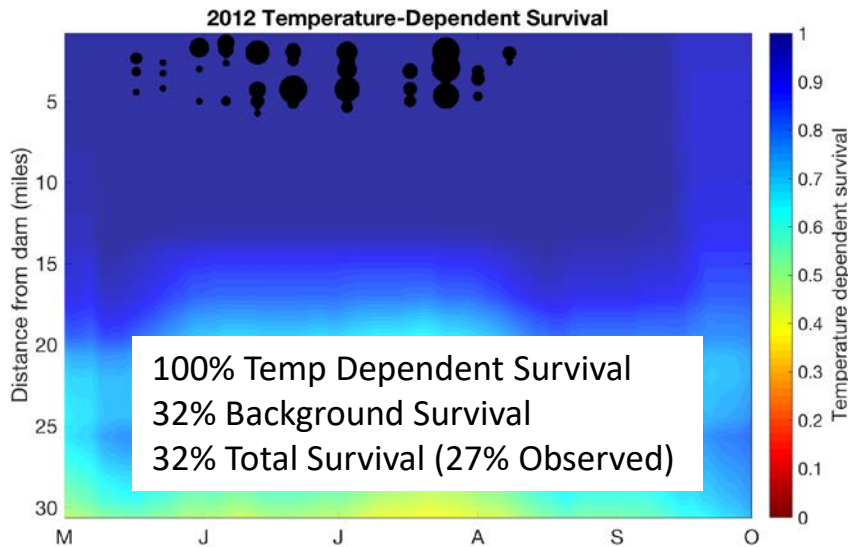


Temperature  
Dependent  
Survival

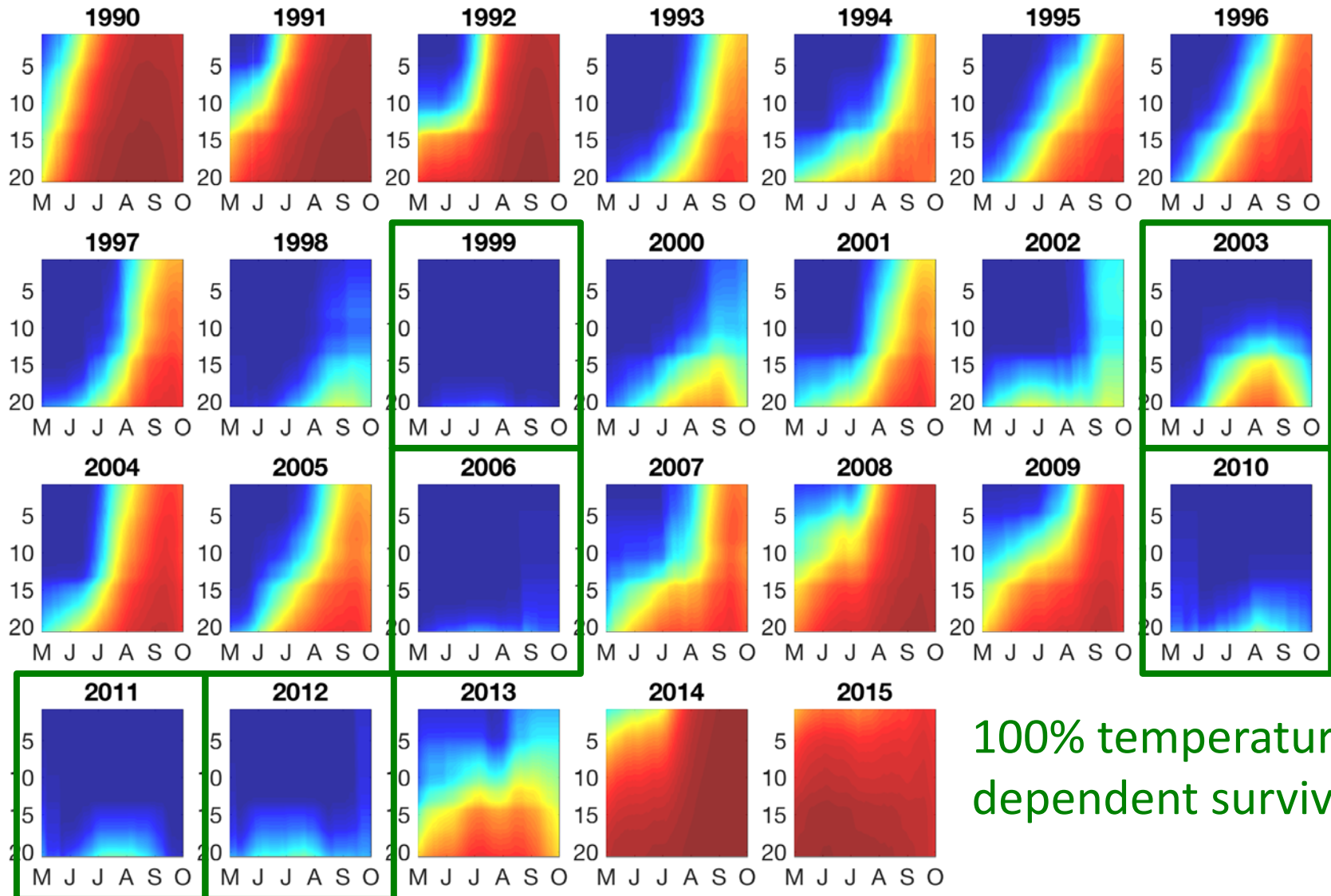


Total  
Survival

# As we head into a drought...



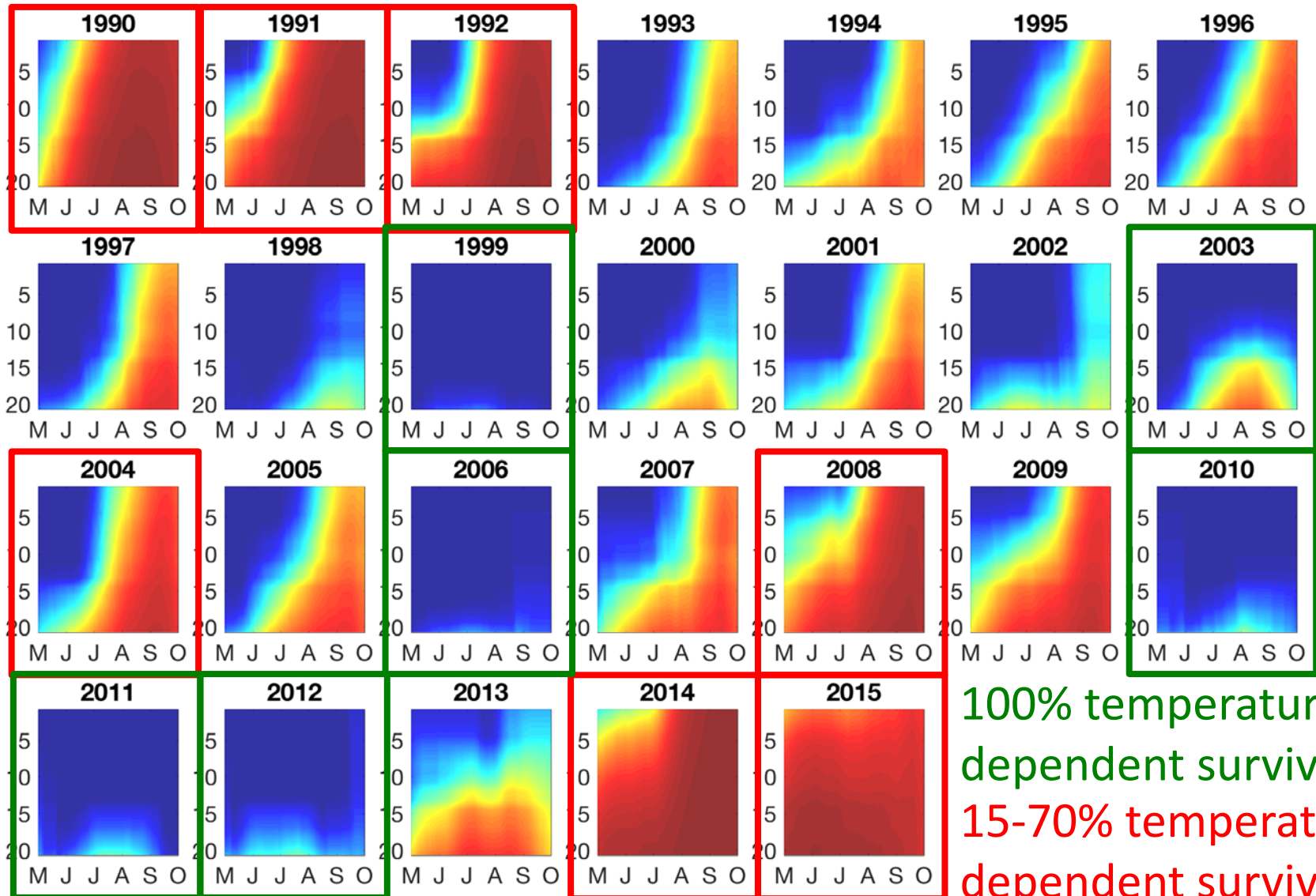
# Egg survival as a function of temperature



100% temperature  
dependent survival



# Egg survival as a function of temperature



100% temperature  
dependent survival  
15-70% temperature  
dependent survival



# Decision Support Tools

- Beyond Temperature
- How can we use these models to inform management?

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River Assessment for Forecasting Temperatures



## Temperature

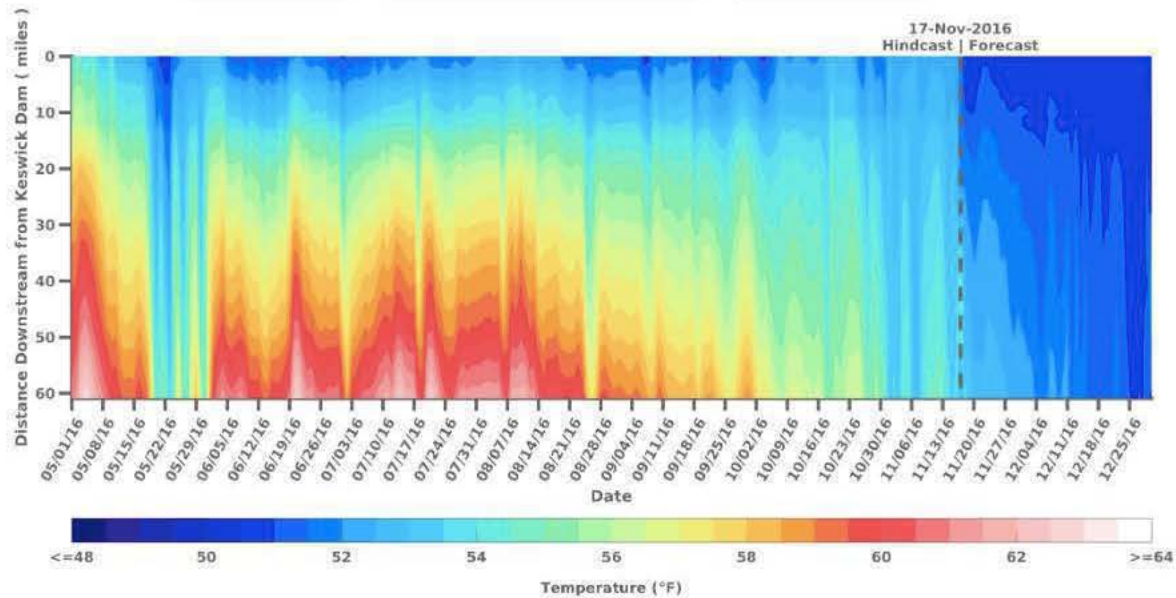
Whole-river plots

Overlay layers:

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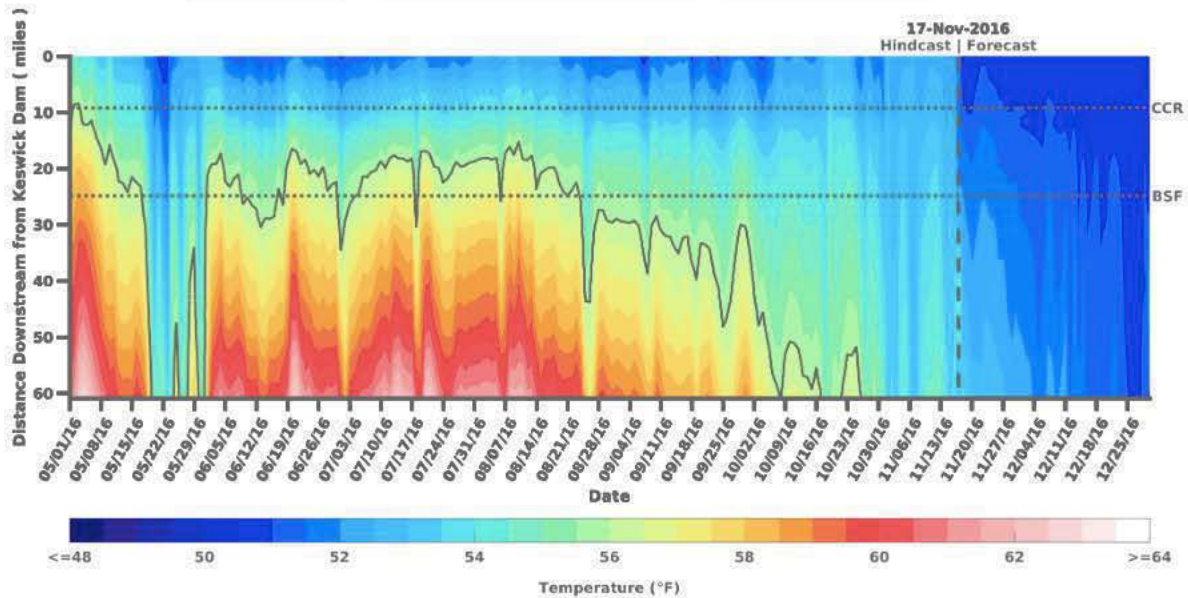
Whole-river plots

Overlay layers:

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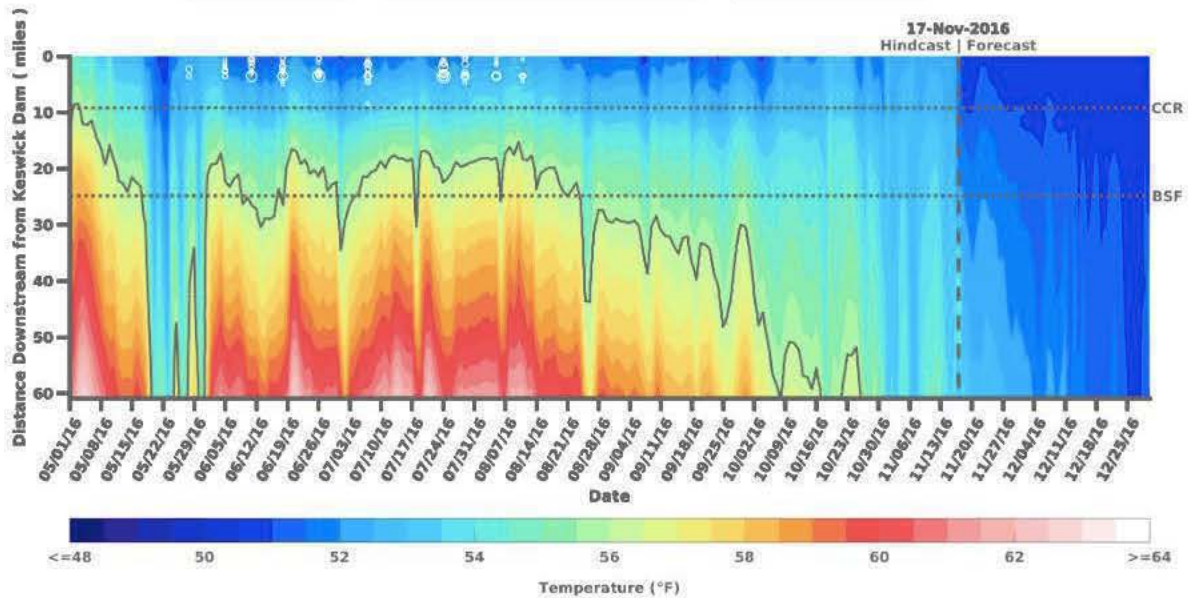
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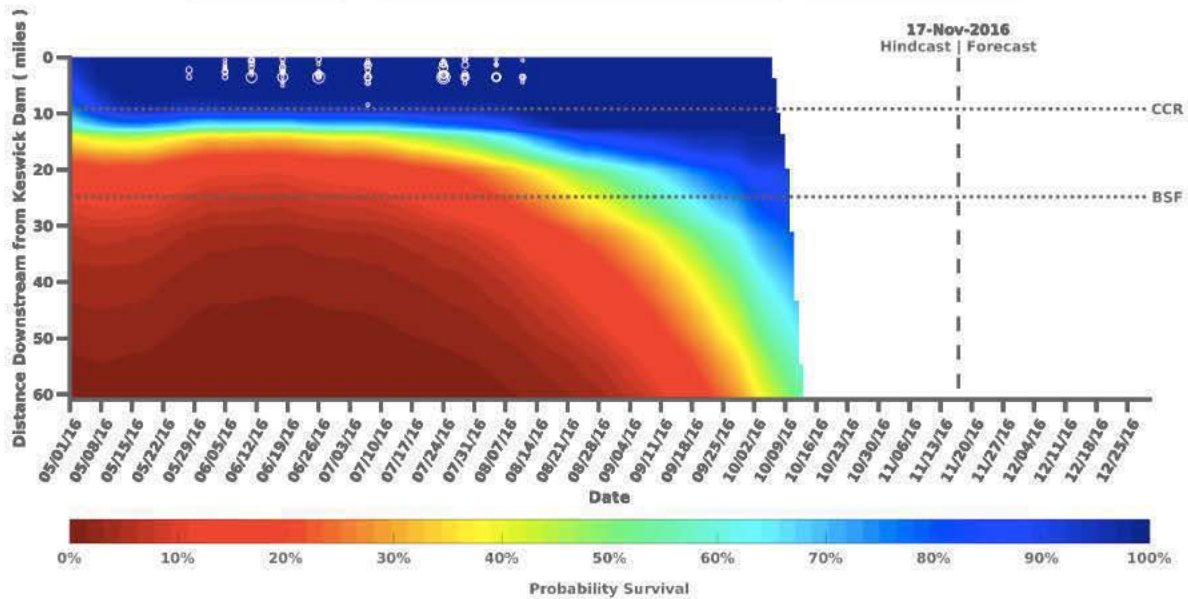
Whole-river plots

Overlay layers:

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## Survival

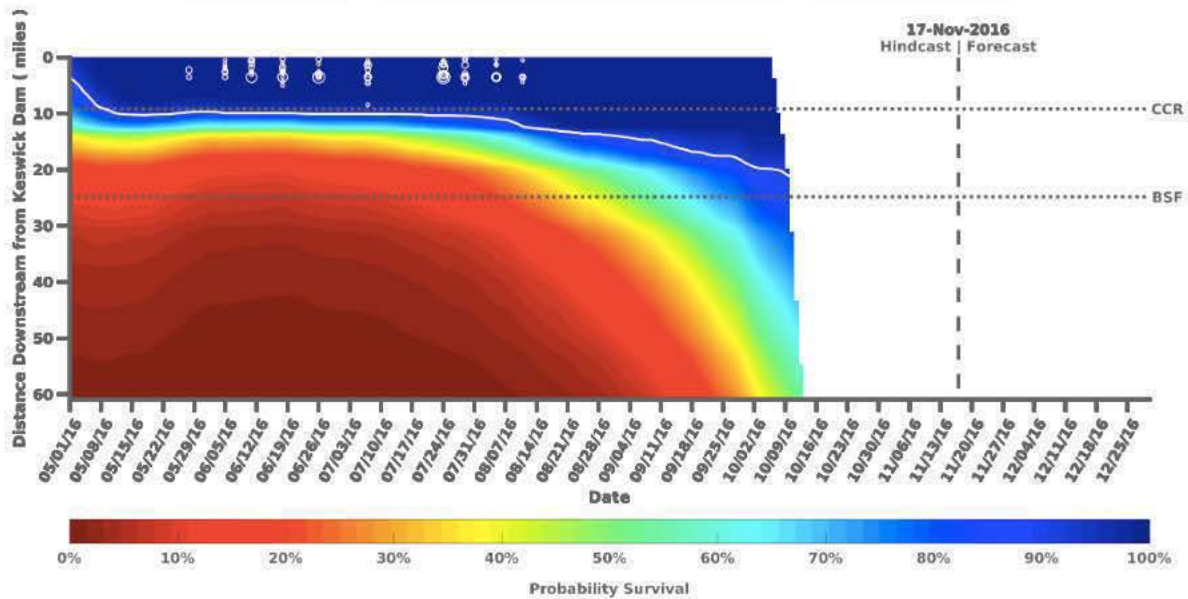
Whole-river plots

Overlay layers:

STATIONS

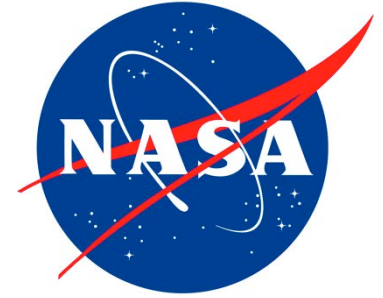
PROBABILITY SURVIVAL CONTOURS

OTHER LAYERS



# Summary

- Water temperatures are critical
- Beyond temperature
- Biophysical models, mechanistic understanding of the system and survival
- Decision support tools



Thank you

This work is supported by funding from  
NASA Applied Sciences  
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and  
NOAA Fisheries

