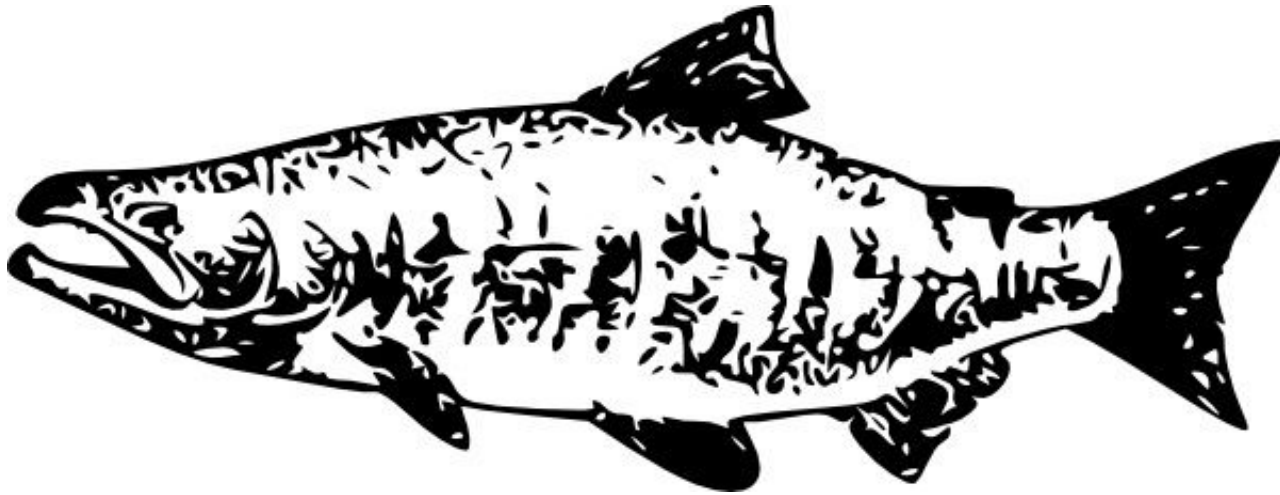


# FUTUREFISH

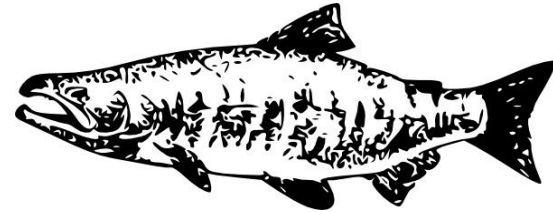
*Projecting salmon habitat in the Pacific Northwest  
under climate change.*



Andrew Bennett, Katie Brennan, Oriana Chegwidden, Jennifer Hsiao, Serena Liu

# WHO WERE WE?

- An atmospheric scientist
- A biologist
- Two civil engineers
- And a genome scientist!

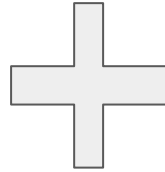


PROBLEM:

HOW WILL CLIMATE CHANGE AFFECT  
SALMON IN THE PACIFIC NORTHWEST?

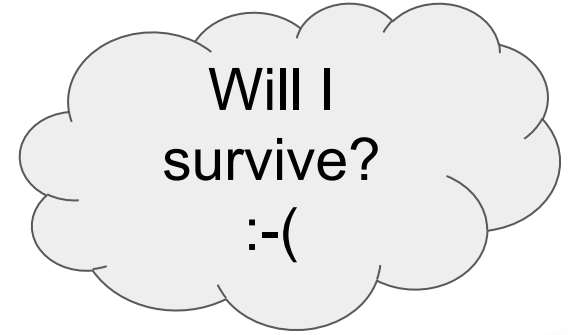
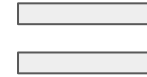


# WHAT DO WE WANT TO DO?



Change in  
streamflow  
volume

Change in  
water  
temperature



# USE CASES:



nonprofit

# DATA WE USED: STREAMFLOW VOLUME

UW Hydro | Columbia River Climate Change

[HOME](#)

[DOCUMENTATION](#)

[DATA](#)

[TEAM](#)

## Hydrologic Response of the Columbia River Basin to Climate Change





# DATA WE USED: STREAM TEMPERATURE



UNITED STATES DEPARTMENT OF AGRICULTURE - U.S. FOREST SERVICE

Rocky Mountain Research Station  
Air, Water, & Aquatic Environments Program



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☒ search only AWAE



**NorWeST**  
Stream Temp

*Regional Database and Modeled Stream Temperatures*



Great Northern  
LANDSCAPE CONSERVATION COOPERATIVE



science for a changing world





# DATA WE USED: EMPIRICAL RELATIONSHIPS

91

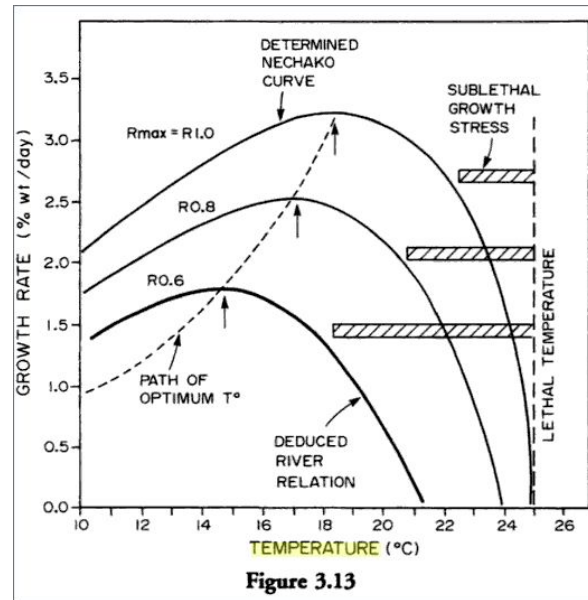
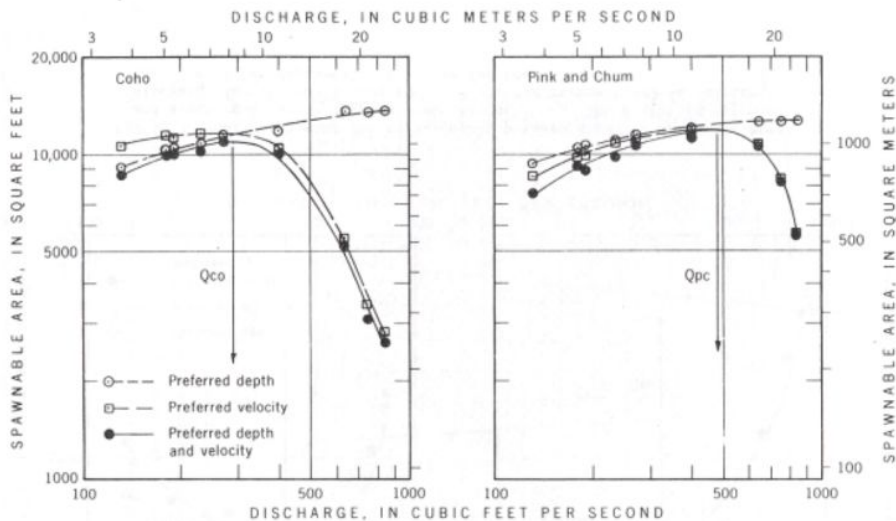
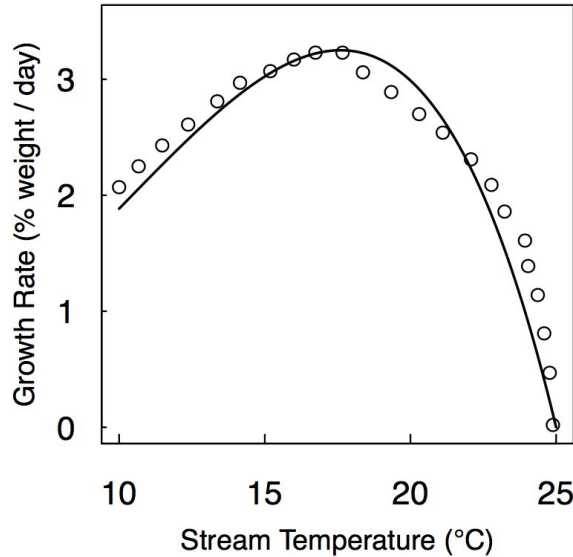


Figure 3.13

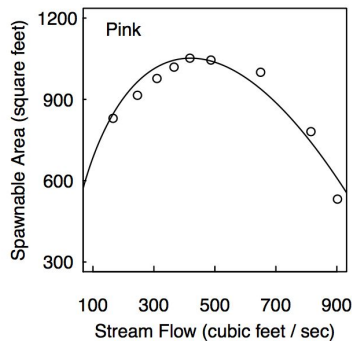
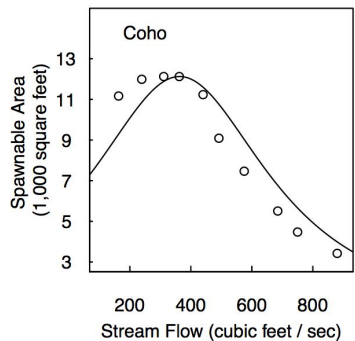
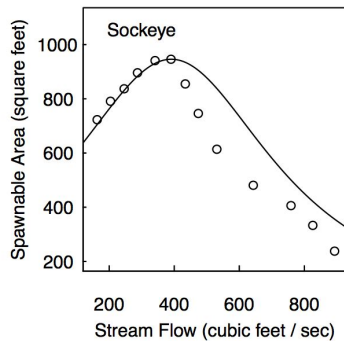
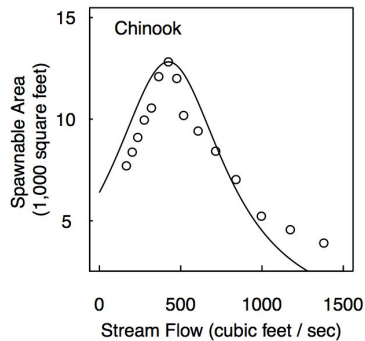
# MODELING THE IMPACTS ON FISH:



Temperature Model

$$R = R_{max} * \left( \frac{T_{max} - Temp}{T_{max} - T_{opt}} \right) * \left( \frac{Temp - T_{min}}{T_{opt} - T_{min}} \right) \frac{T_{opt} - T_{min}}{T_{max} - T_{opt}}$$

# MODELING THE IMPACTS ON FISH:



Streamflow Model:  
Different between species

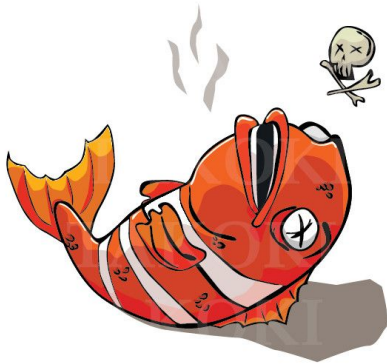
$$SpawnArea = \frac{a}{1 + \left( \frac{Flow - F_o}{b} \right)^2}$$

$$SpawnArea = A_{max} * \left( \frac{F_{max} - Flow}{F_{max} - F_{opt}} \right) * \left( \frac{Flow - F_{min}}{F_{opt} - F_{min}} \right)^{\frac{F_{opt} - F_{min}}{F_{max} - F_{opt}}}$$

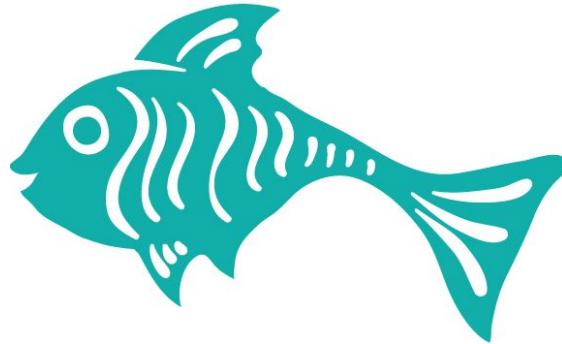
# MODELING THE IMPACTS ON FISH:

Equal weight assigned to temperature and streamflow model, translating model output into salmon viability ranks of 1-5

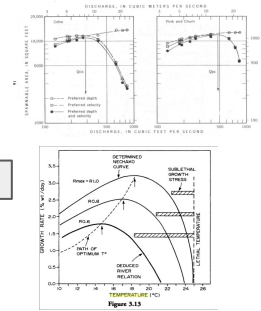
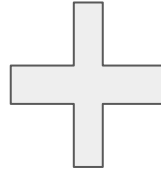
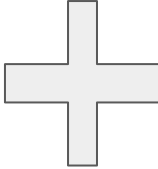
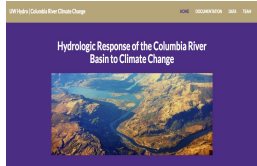
**1 (red): Sad Fish**



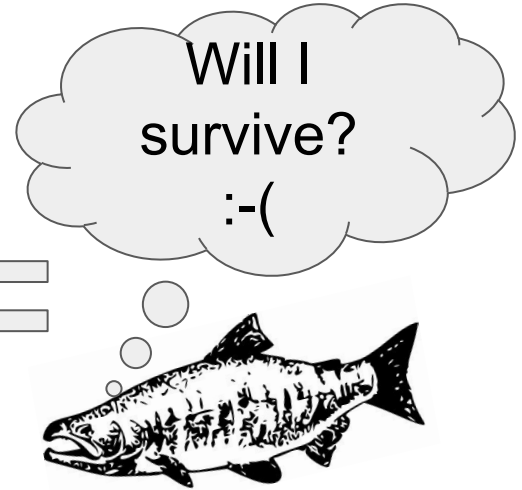
**5 (green): Happy Fish : )**



# INTEGRATING THE DATA



=



# PROJECTION TIME SERIES

- Historical Period: 1993-2005
- Year 2030-2059
- Year 2070-2099

# DESIGN:

- **Driver** (`futurefish_dash.py`):

Script that sets up and runs HTML server

- **Layout generator** (`dashboard.py`):

Sets initial layout and manages HTML

- **Interaction layer** (`interactions.py`):

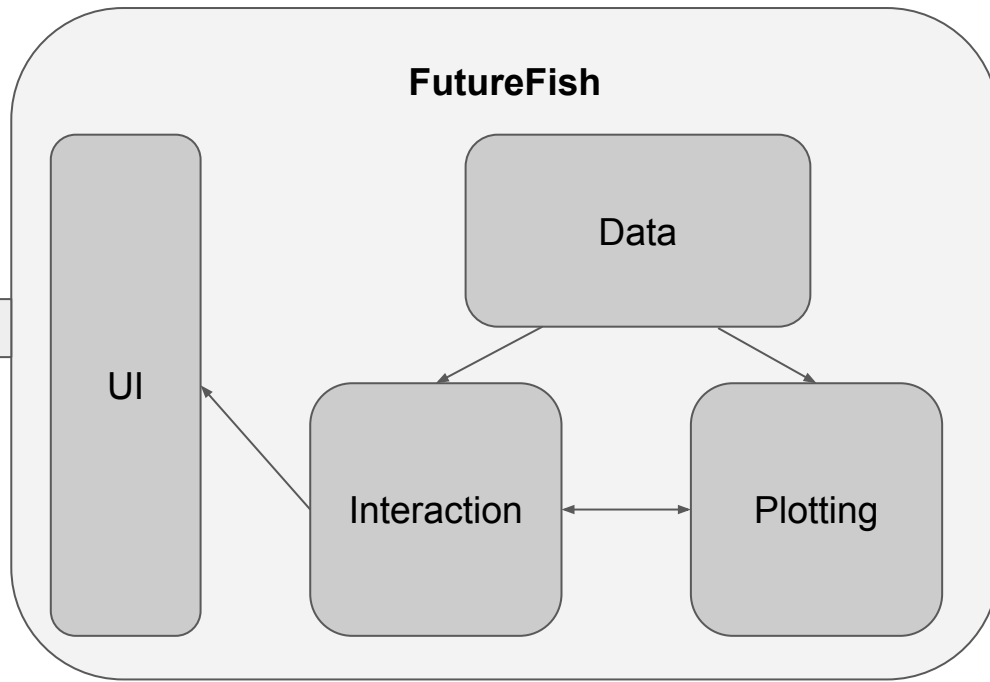
Connects HTML layout to plotting capabilities

- **Plotting** (`plotting.py`):

Processes datasets based on given inputs from interaction

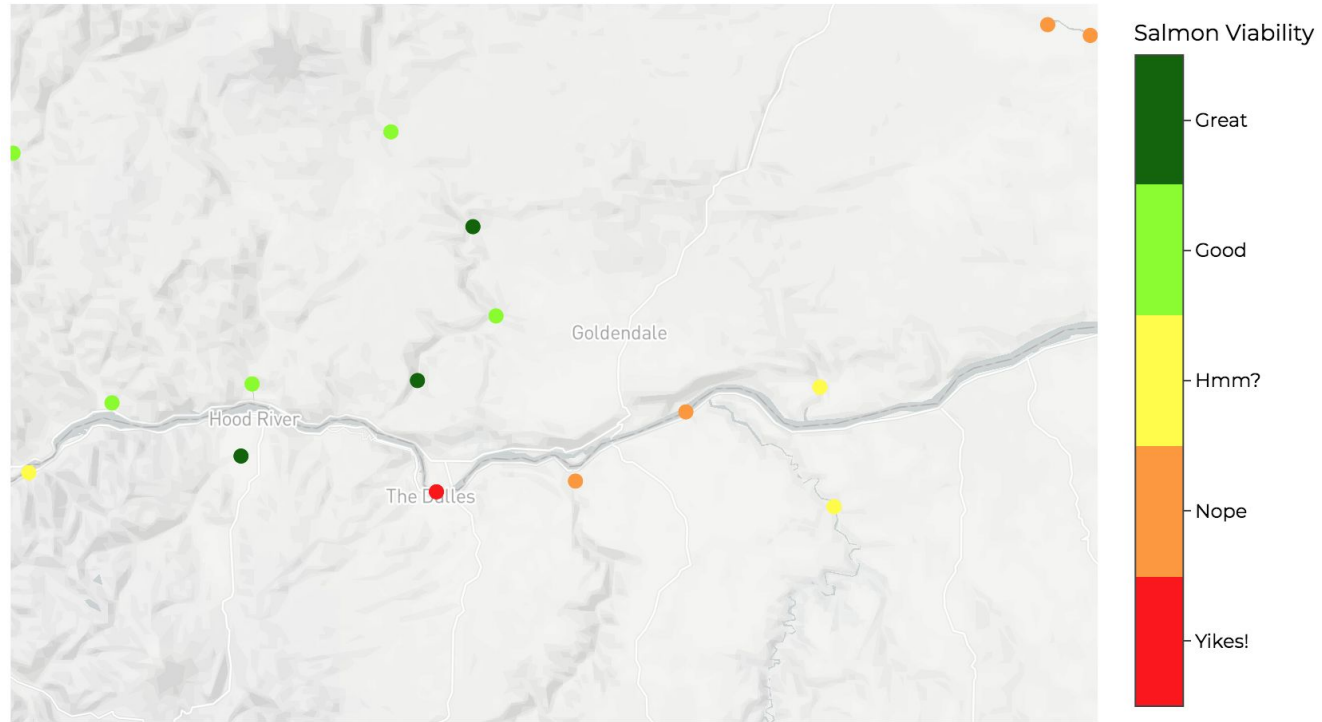


# DESIGN:



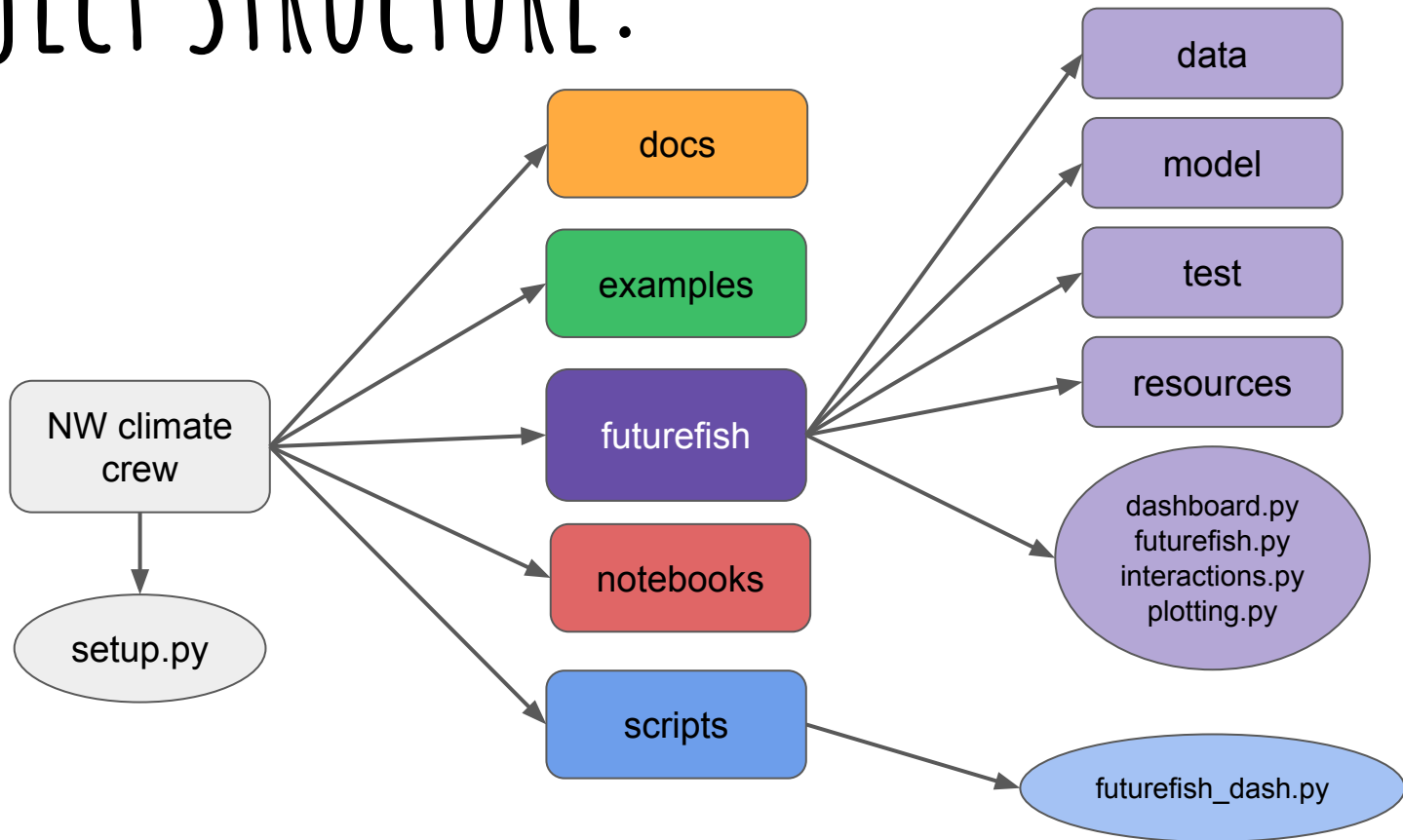
# DEMO:

## Salmon Viability in the Pacific NW



☒ Lock View ☐ Refresh View

# PROJECT STRUCTURE:



# LESSONS LEARNED

+

# FUTURE WORK:

- Start writing tests earlier
- Be diligent about documentation
- Utilize branches earlier
  - Each have our own

- Launch as a stand alone webpage
- Update the viability calculations → consult with fish biologists