

Building fishing community resilience to harmful algal blooms



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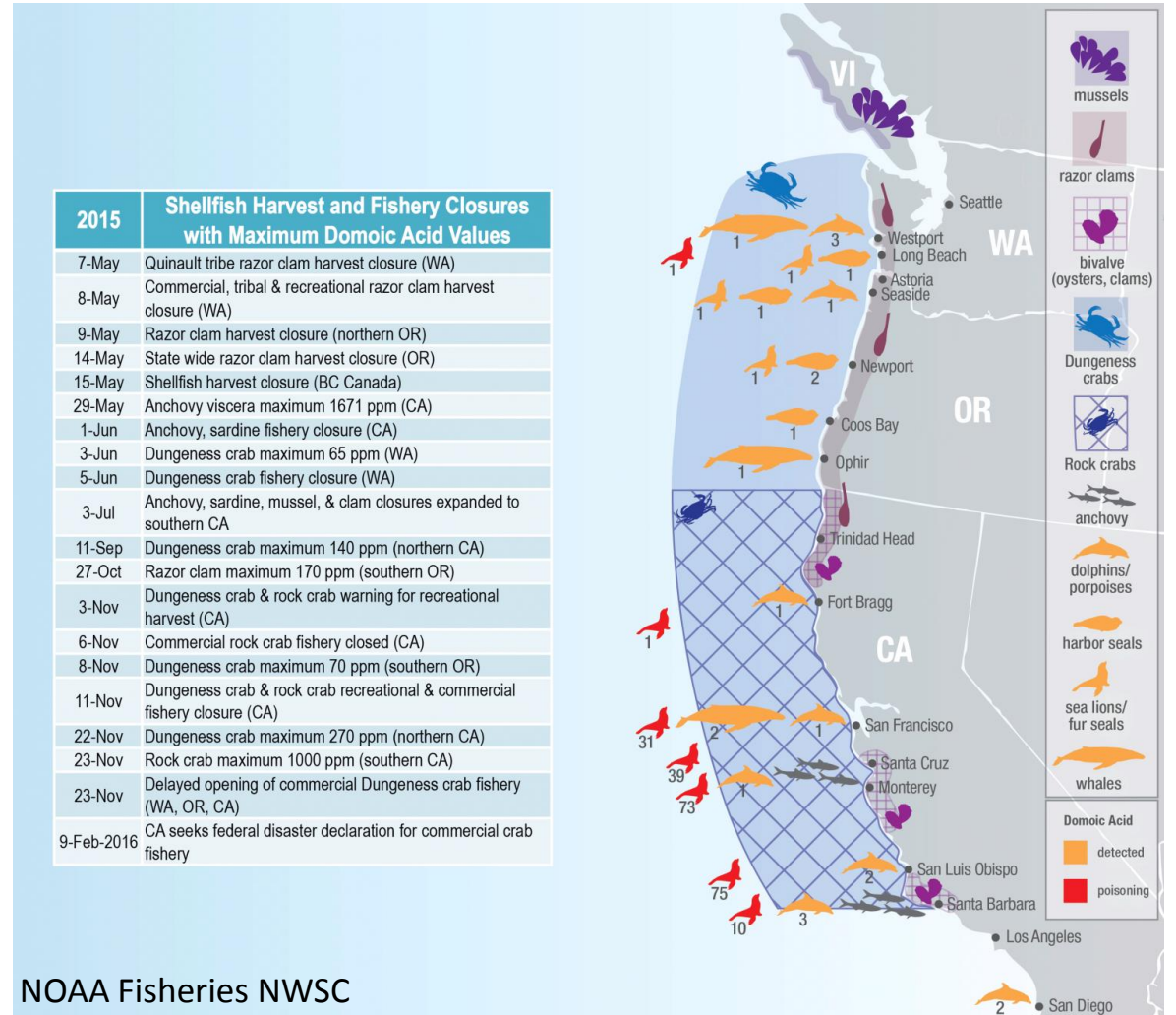
Biggest-ever toxic algal bloom hits West Coast, shutting down shellfish industries

-The Oregonian, June 16, 2015

California's commercial Dungeness crab season postponed indefinitely over toxin risk



Kory Cropper, left, loads crab traps into the Amber Lynn before the start of the dungeness crab season in Bodega Bay on Wednesday, November 13, 2013. (Conner Jay/The Press Democrat)



NOAA Fisheries NWSC

Research Goals: Assess socioeconomic impacts and identify effective coping strategies

Socioeconomic Impacts

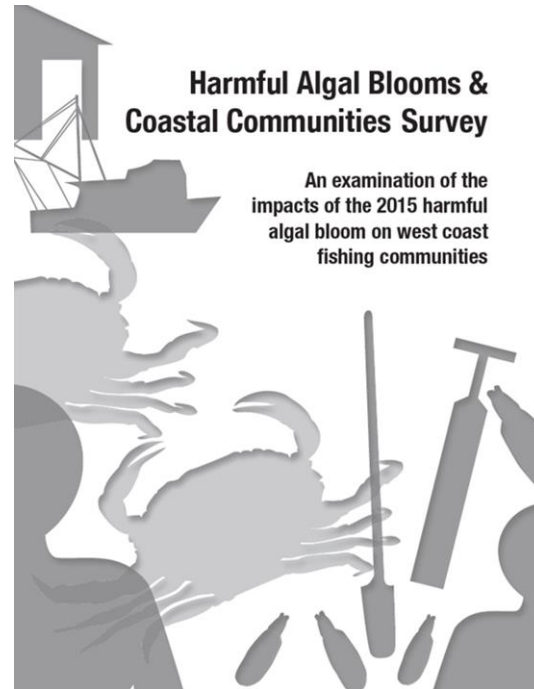
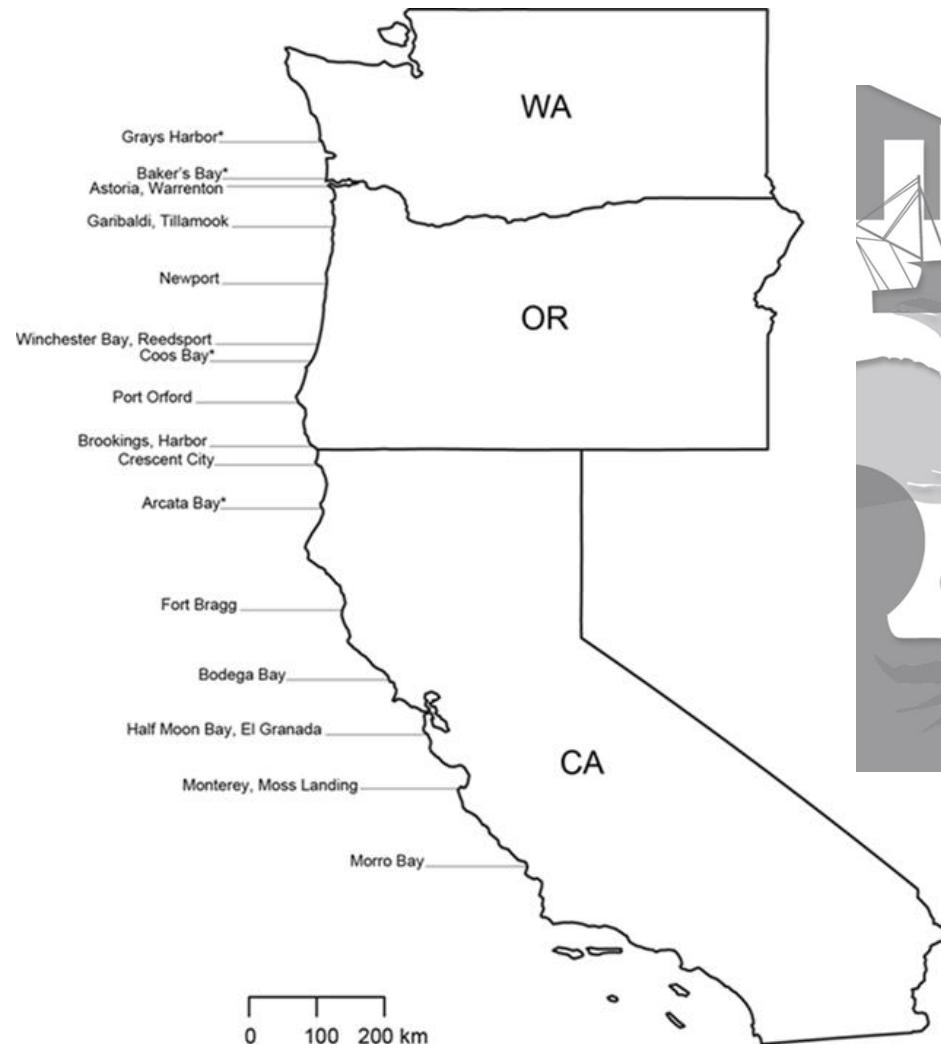
Income losses

Income recovery

Emotional wellbeing



A mixed mode survey collected primary data across 16 west coast communities



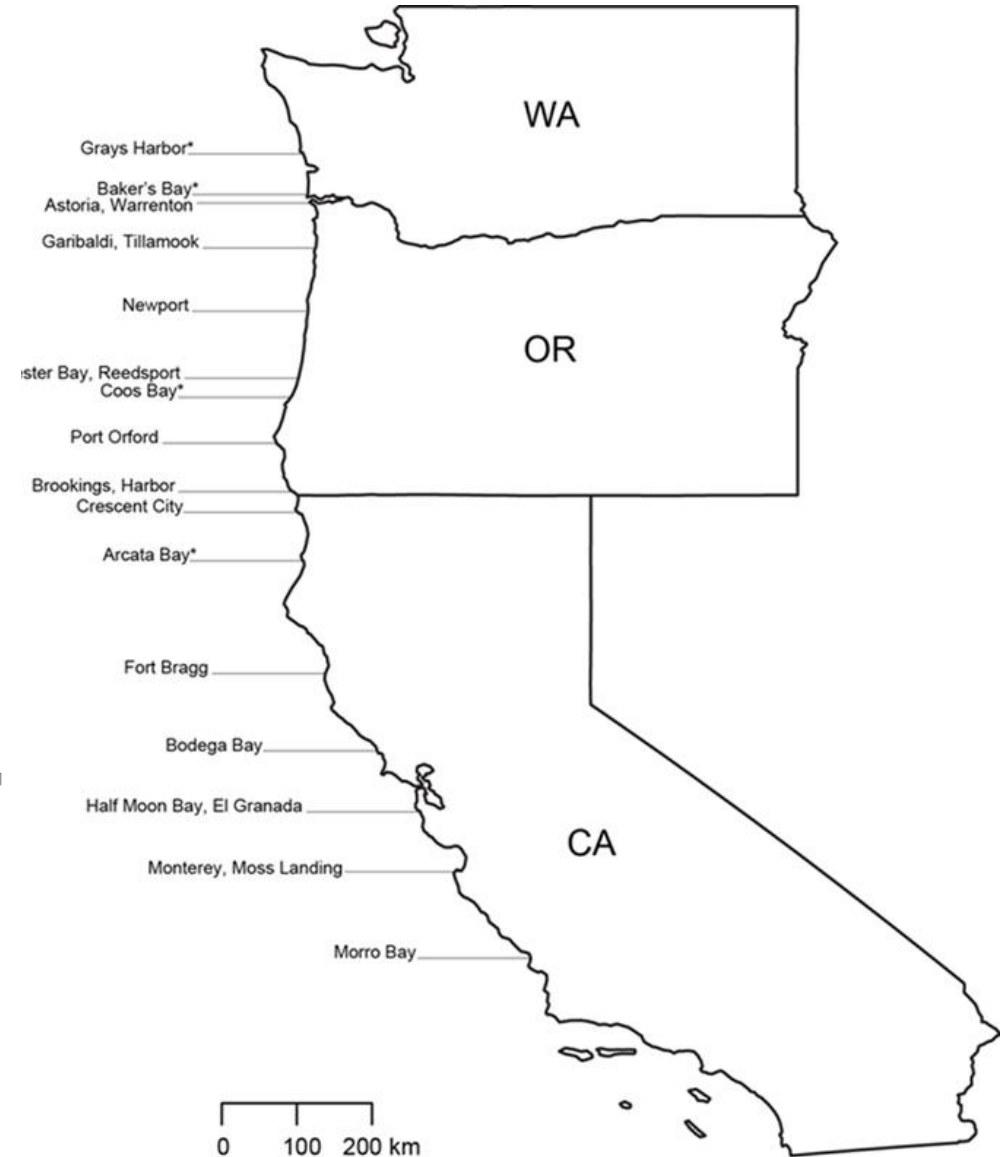
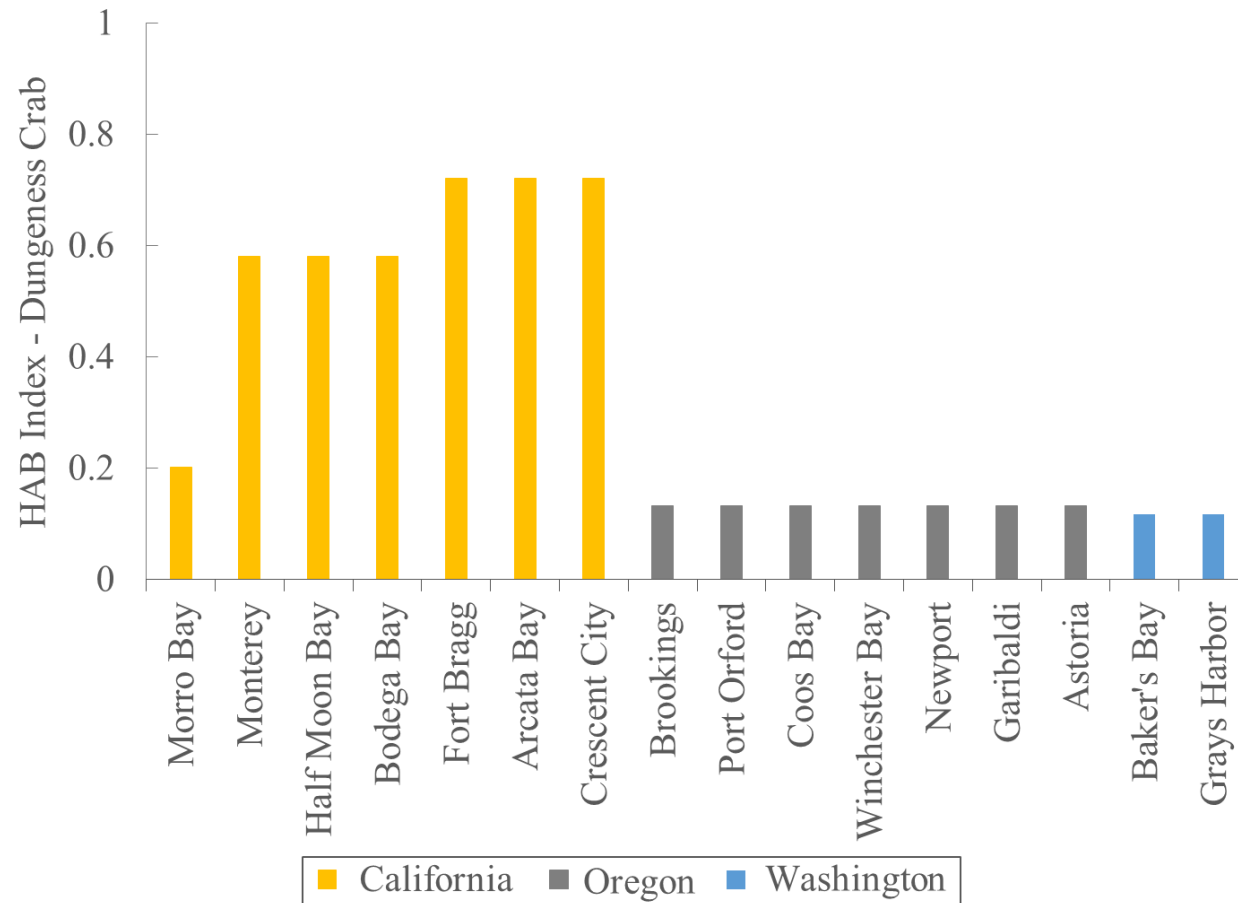
- **Mail**

- Sampling frame from InfoUSA
- Dungeness crab permit holders from PacFin

- **Online**

- Advertised via state agency email lists
- Participants self-selected

HAB Closures of the Dungeness Crab Fishery were longest in California



Model specifications

Socioeconomic Impacts

Income losses

Income recovery

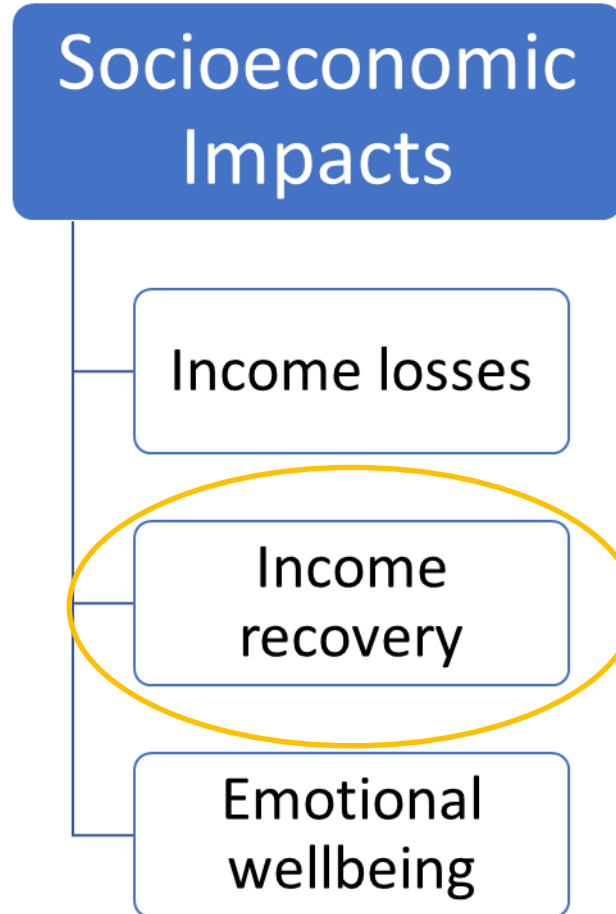
Emotional wellbeing

$$\Pr(\text{Income loss} = m \mid \mathbf{x}_i) = \Lambda(\tau_m - \mathbf{x}\boldsymbol{\beta}) - \Lambda(\tau_{m-1} - \mathbf{x}\boldsymbol{\beta})$$

where

$$\begin{aligned} \mathbf{x}\boldsymbol{\beta} = & \beta_1 \text{HAB Index} \\ & + \beta_2 \text{Industry} \\ & + \beta_3 \text{HAB Index} \times \text{Industry} \\ & + \beta_4 \text{Business Owner} \\ & + \beta_5 \text{Shellfish dependence} \\ & + \beta_6 \text{Income bracket} \end{aligned}$$

Model specifications



$$\Pr(\text{Income recovery} = 1 | \mathbf{x}) = \Lambda(\beta_0 + \beta_1 \text{Income loss} + \beta_2 \text{Income bracket} + \beta_3 \text{Industry} + \beta_4 \text{Business Owner} + \beta_5 \text{Alternate Fishing} + \beta_6 \text{Alternate Job} + \beta_7 \text{Advertising} + \beta_8 \text{Discounts} + \beta_9 \text{Trade/Barter})$$

Model specifications

Socioeconomic Impacts

Income losses

Income recovery

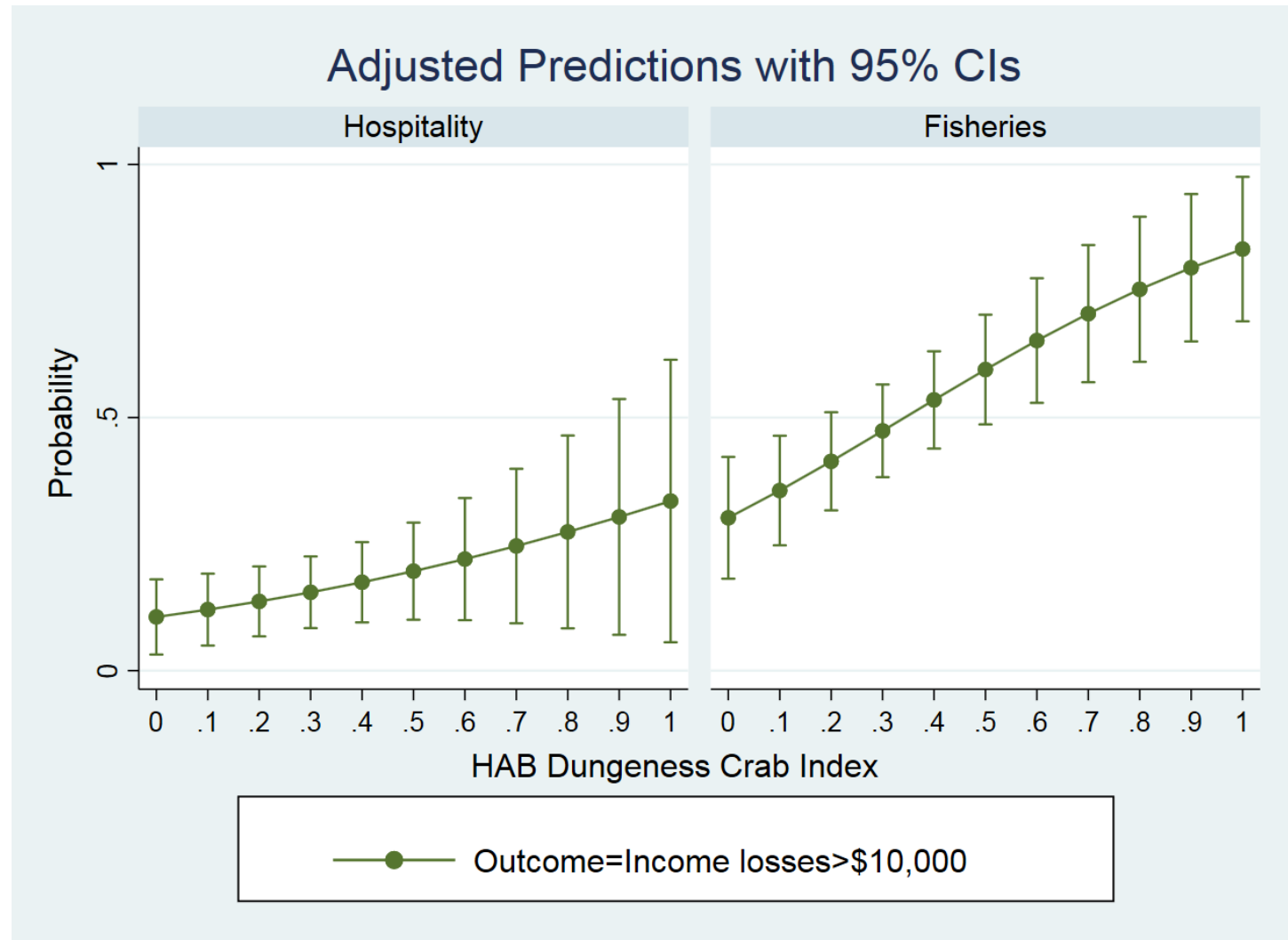
Emotional wellbeing

$$\Pr(\text{Stress} = m \mid \mathbf{x}_i) = \Lambda(\tau_m - \mathbf{x}\boldsymbol{\beta}) - \Lambda(\tau_{m-1} - \mathbf{x}\boldsymbol{\beta})$$

where

$$\begin{aligned} \mathbf{x}\boldsymbol{\beta} = & \beta_1 \text{Income loss} + \beta_2 \text{Income recovery} \\ & + \beta_3 \text{Income bracket} + \beta_4 \text{Business Owner} \\ & + \beta_5 \text{Traditions impacted} + \beta_6 \text{Alternate Fishing} \\ & + \beta_7 \text{Alternate Job} + \beta_8 \text{Advertising} \\ & + \beta_9 \text{Trade/Barter} + \beta_{10} \text{Borrow} \\ & + \beta_{11} \text{Assistance} + \beta_{12} \text{Default} \end{aligned}$$

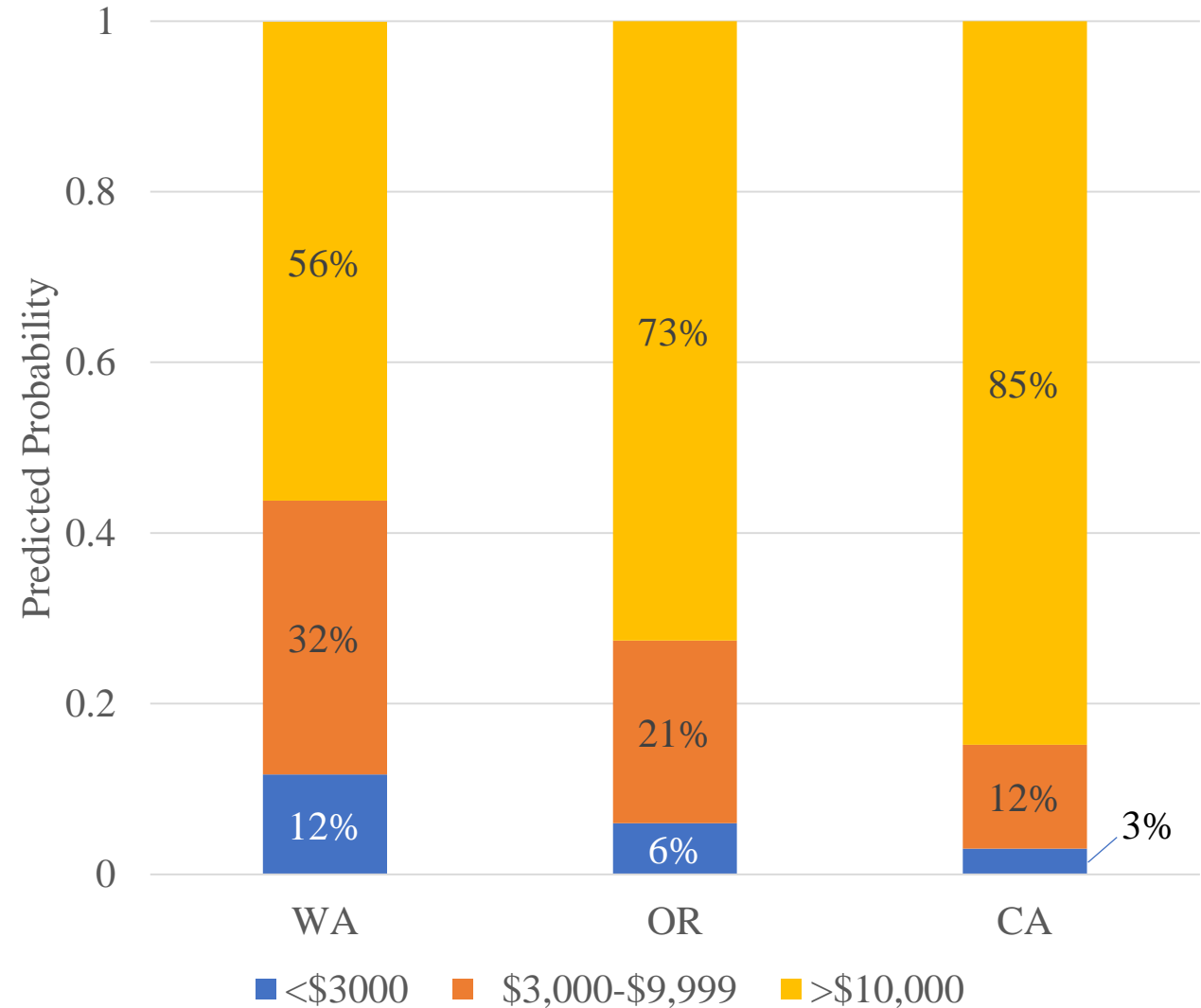
All else the same, fisherman experienced greater income losses than individuals in hospitality.



Predicted probability of income loss for representative owner/operator fisherman by State

Covariates: ↓

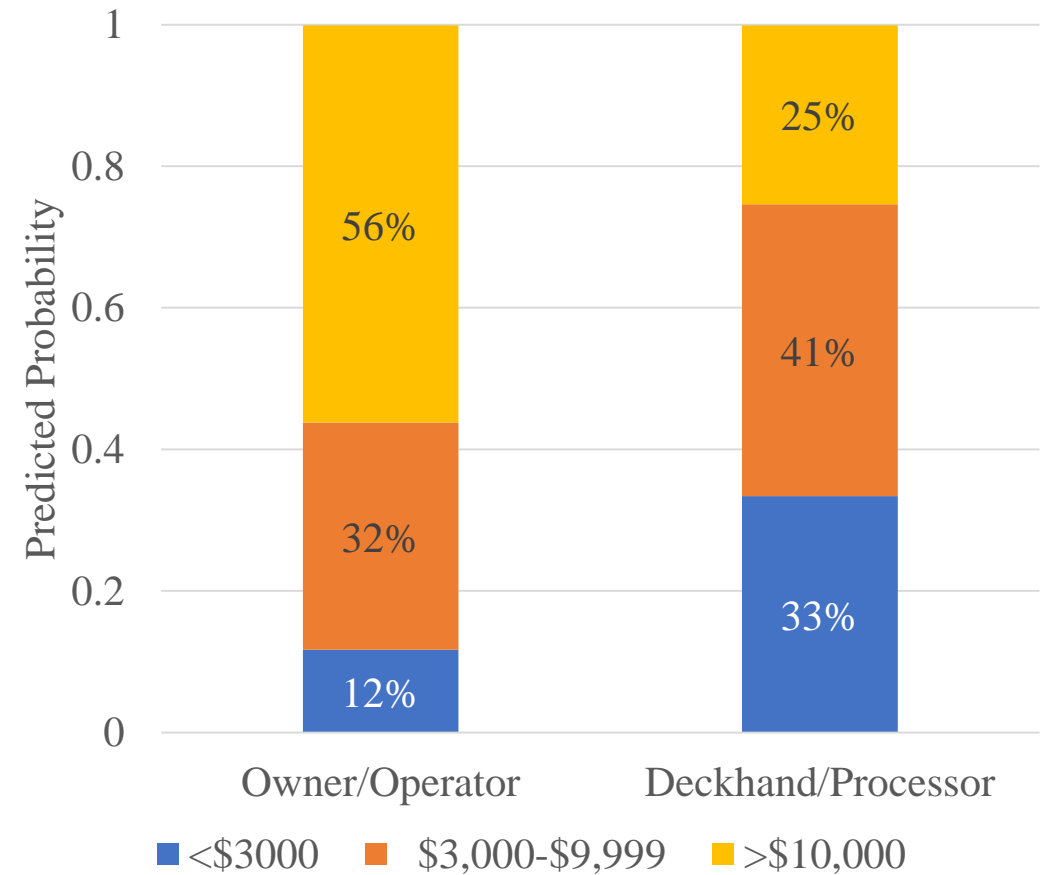
	WA	OR	CA
HAB Index	0.1	0.1	0.7
Income bracket	\$50K - \$100K	>\$100K	\$50K - \$100K
Shellfish Dependence	50-75%	50-75%	50-75%



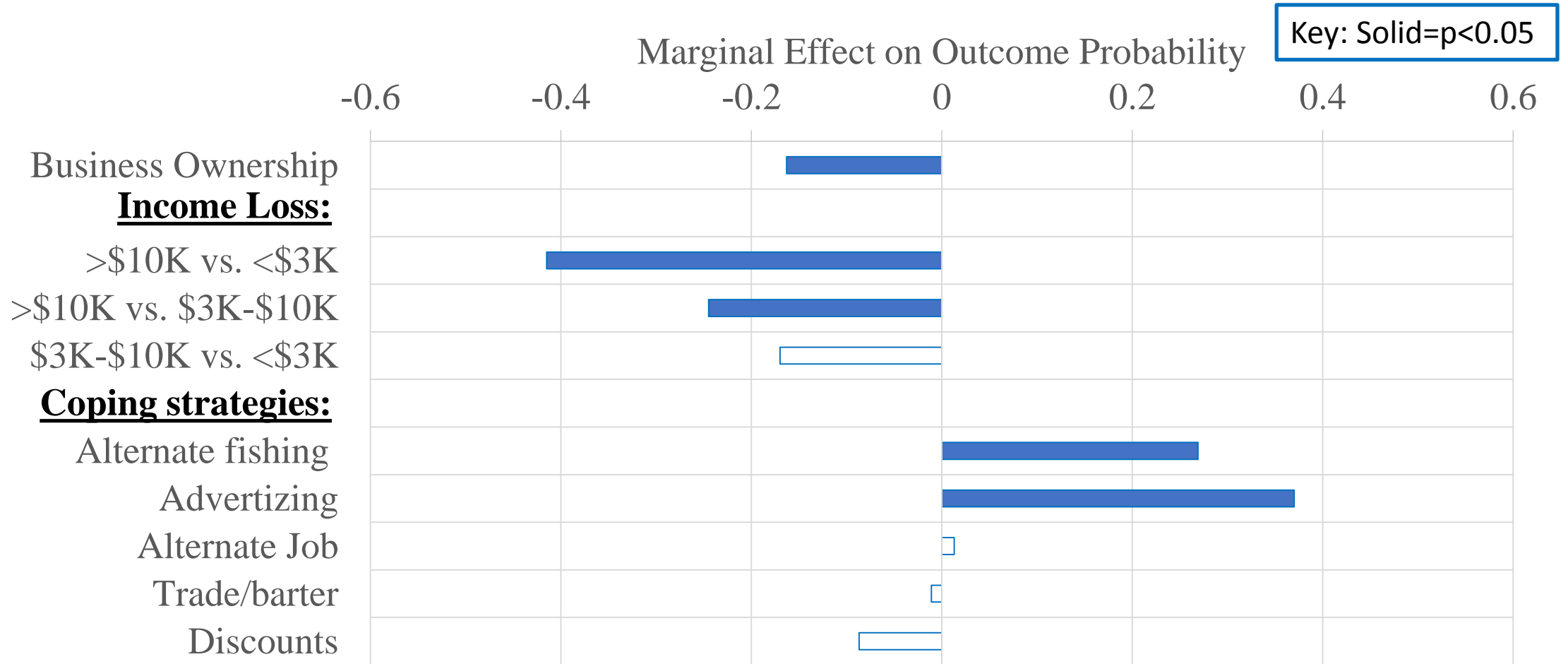
Employment hierarchy matters for likely magnitude of income losses

Covariates:

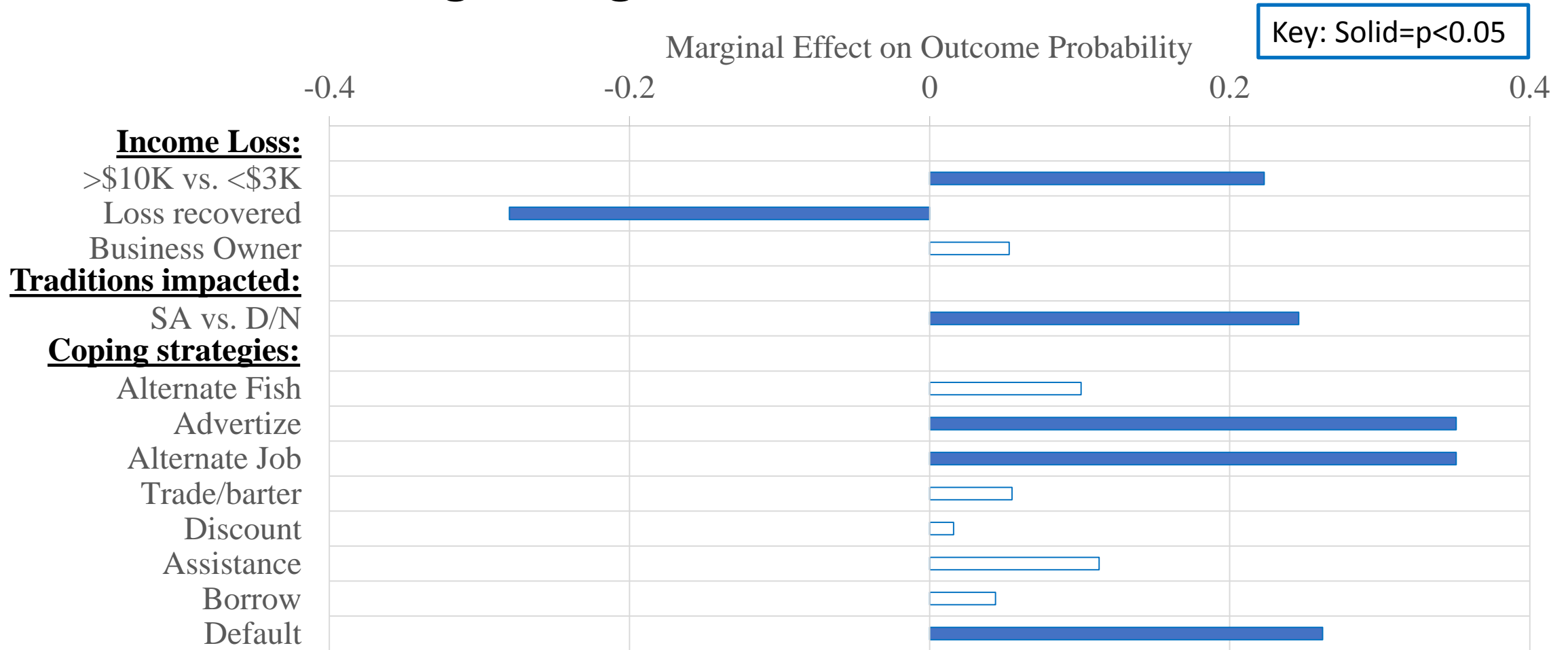
Employment Industry	Fishing
HAB Index	0.1
Income bracket	\$50K - \$100K
Shellfish Dependence	50-75%



The average probability of income recovery for fisherman was 0.3.



Stress experienced: the average probability of strongly agreeing was 0.4 for fisherman.

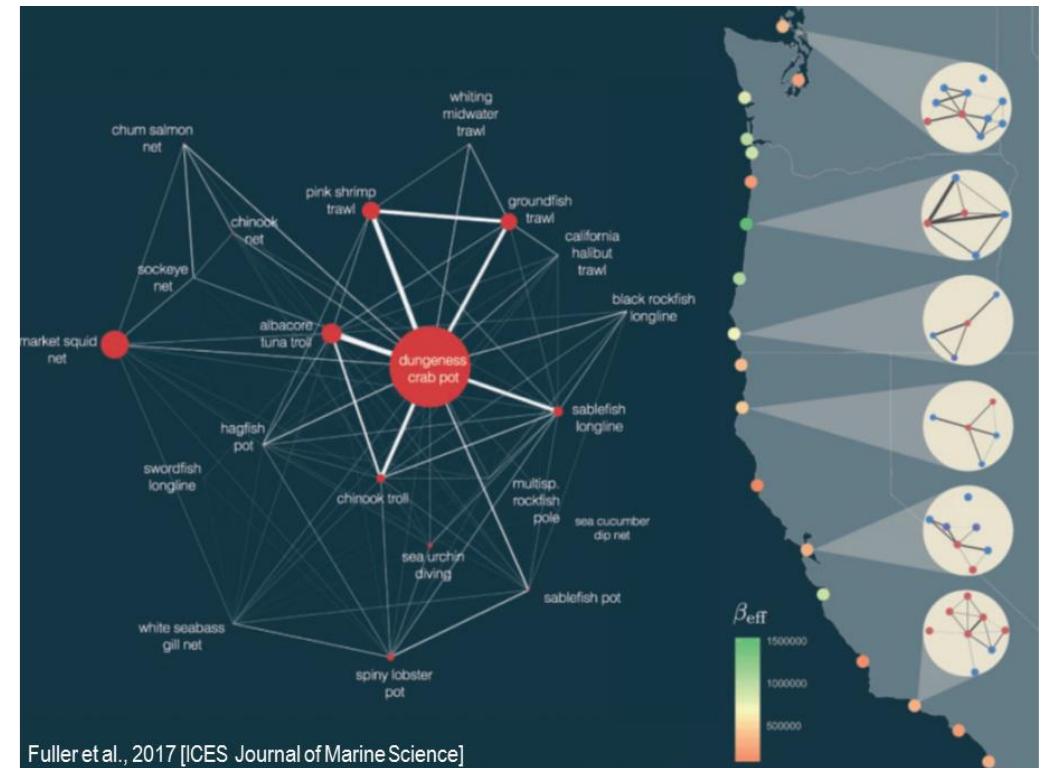


Next steps

**Examine HAB impacts to recreation
razor clam fishery**



**Investigate alternate fishing strategies
via fisheries participation networks**



Thank you!

Acknowledgments

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